THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. FEBRUARY 1, 1900. CHICAGO, ILL. NUMBER 5

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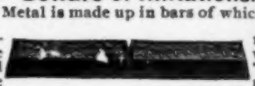

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Lake Superior Iron Ore Shipments (Gross Tons

NAME OF MINE.	Prior to 1883.	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	TOTALS.
Marquette Range.																			
American (Sterl'g)..	13,505	3,618	2,916	.....	.....	1,483	13,699	20,032	21,000	21,604	15,076	.....	.....	.....	.....	.....	.....	.....	112,933
Ames	530,089	62,752	69,408	47,458	52,975	16,123	10,211	12,835	.....	.....	.....	1,103	5,195	.....	.....	.....	.....	.....	6,298
Barnum (B)	16,006	631	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	801,851
Bay State	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,637
Bessie	.....	.....	.....	.....	.....	.....	.....	.....	.....	847	.....	.....	.....	.....	.....	.....	.....	.....	847
Beauford	5,532	18,976	18,360	17,166	17,354	12,829	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90,217
Blue	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,809	32,171	44,140	.....	2,519	.....	.....	92,639
Boston	39,547	20,190	2,218	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	587	.....	.....	.....	62,542
Buffalo (A)	.....	.....	.....	.....	10,860	24,686	30,801	50,919	100,464	.....	.....	.....	.....	.....	.....	.....	.....	.....	217,730
Braastad { Mitch'l	109,109	.....	.....	.....	7,017	16,419	4,091	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136,636
Braastad { Wint'p.	279,305	50,143	73,144	53,913	58,743	74,067	86,789	155,341	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	831,445
Cambria	120,249	47,508	59,742	50,796	58,784	41,130	57,861	72,780	80,359	34,662	41,549	30,445	47,218	41,656	95,086	110,648	102,623	124,930	1,218,026
Champion	1,134,916	104,960	210,180	173,915	137,593	146,330	174,680	215,098	223,442	133,413	109,979	61,648	42,788	100,398	113,375	141,728	163,190	215,074	3,602,707
Chicago	8,895	117	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,012
Cleve'd-Cliffs I. Co.	2,631,199	218,219	225,674	218,757	203,664	207,441	184,316	274,048	831,713	221,788	310,907	218,105	143,706	221,153	513,119	718,408	869,482	1011,048	8,722,747
Columbia (Klom'n)	94,099	714	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	94,813
Curry	.....	.....	.....	.....	.....	.....	.....	16,671	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,671
Detroit	5,402	12,314	3,809	19,125	39,400	26,099	18,500	10,112	6,080	.....	.....	.....	.....	.....	.....	.....	.....	.....	140,841
Dexter	.....	4,878	16,202	750	.....	.....	1,821	3,895	9,136	5,448	13,000	7,833	21,740	13,752	18,903	1,154	.....	.....	118,512
Dey	.....	.....	2,709	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,709
East Champion	68,266	5,039	.....	.....	.....	.....	.....	2,697	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	76,002
East New York	.....	.....	.....	.....	.....	.....	13,694	29,739	36,431	50,293	35,175	911	.....	.....	.....	.....	.....	.....	166,243
Edison	.....	.....	.....	.....	.....	.....	.....	893	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	893
Erie	2,731	5,405	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,136
Etna	.....	1,091	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,091
Fitch	.....	.....	.....	.....	.....	.....	.....	.....	16,550	15,093	.....	.....	.....	174	.....	.....	.....	.....	31,817
Foster (B)	120,597	10,029	9,675	9,643	.....	.....	.....	.....	21,949	.....	.....	.....	.....	.....	.....	.....	.....	.....	171,893
Gibson	.....	.....	.....	1,515	12,142	2,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,357
Goodrich	49,754	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49,754
G'd Rapids (Davis)	.....	.....	.....	.....	.....	1,200	11,611	20,058	26,426	9,362	22 823	352	12,073	6,764	67	.....	.....	.....	110,736
Hartford	.....	.....	.....	.....	.....	.....	.....	566	.....	.....	5,678	6,513	.....	.....	1,532	.....	.....	.....	14,289
Hortense(N.Ch'p'n)	.....	.....	.....	.....	.....	886	5,685	7,757	16,246	.....	.....	.....	.....	.....	.....	.....	.....	.....	30,574
Humboldt	538,959	31,866	23,763	11,766	20,207	19,873	11,655	15,866	23,259	19,879	4,571	.....	.....	.....	2,297	.....	.....	.....	723,961
Iron Cliffs (K)	.....	.....	.....	.....	.....	87,346	78,520	134,616	188,776	278,270	289,395	130,812	253,760	259,042	.....	.....	.....	.....	1,700,537
Imperial	.....	.....	.....	.....	.....	.....	.....	.....	38,460	18,552	7,194	.....	.....	.....	.....	.....	.....	23,235	87,441
Iron Mountain	.....	.....	.....	.....	.....	393	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	393
Jackson	2 291,992	71,278	83,251	68,657	89,370	109,906	101,909	128,891	121,682	92,979	92,567	51,009	32,298	42,186	80,716	79,102	55,012	88,230	3,684,029
Lake Superior	2,992 965	200,799	204,796	226,040	267,622	302,909	240,225	288,784	318,321	308,831	366,715	329,610	344,758	342,439	459,576	376,761	686,563	682,935	8,940,309
Lillie	109.547	4 614	2,683	708	3,957	23,041	32,692	33,916	31,812	19,551	29,005	68,861	78,388	54,285	107,532	112,781	211,023	196,200	1,129,596
Lucy (McCombe)	292,751	14,676	.....	.....	.....	12,139	22,276	32,982	43,483	27,683	26,326	21,964	.....	.....	.....	10,033	11,846	.....	516,159
Manganese	.....	397	1,484	3,111	1,367	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,359
Marquette (C)	.....	.....	.....	.....	5,229	20,441	7,060	70,128	23,692	16,802	9,555	.....	.....	.....	.....	.....	.....	.....	152,907
Mesabi's Friend	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,503	10,540	.....	.....	.....	16,043
Michigamme	486,959	42,533	25,935	12,373	48,790	58,726	36,448	56,999	80,777	23,169	1,894	935	1,610	3,214	.....	.....	.....	.....	880,362
Milwaukee	86 609	805	25,991	38,465	46,693	50,490	48,908	52,727	24,763	.....	.....	.....	.....	.....	.....	.....	.....	.....	375,451
National	115,051	21,178	13,987	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	150,216
Negaunee,	.....	.....	.....	.....	.....	5,259	45,304	78,318	76,488	64,218	85,846	69,732	132,581	90,682	175,394	182,169	191,330	195,573	1,392,894
" Con. Wks.	1,177	10,394	48	.....	1,094	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,708
New York (York)	1,031,807	1,517	1,677	.....	.....	5,128	.....	12,844	2,422	.....	11,220	25,000	21,487	.....	.....	.....	.....	6,642	1,119,744
N. Y. Hematite	37,587	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,587
North Republic	.....	.....	.....	.....	.....	.....	289	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	289
Northwest	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,687	.....	.....	.....	.....	.....	.....	.....	1,687
Norwood	.....	.....	.....	.....	.....	2,200	3,553	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,753
Nonpareil (St. Law.)	9,998	11,961	.....	.....	.....	1,436	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,395
Ogden	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	986	.....	.....	986
Palmer	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,041	.....	.....	.....	1,041
Pascoe	18,880	.....	12,605	18,249	10,072	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,806
Pendill	44,081	318	1,594	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45,993
Phenix (Dalliba)	55,822	1,687	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,114
Pioneer	.....	.....	.....	.....	5,140	1,203	9,066	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15,409
Pitts. & L. Angel'e.	540,023	27,259	86,922	111,051	131,731	191,120	223,600	229,070	261,681	241,605	287,517	351,973	355,453	313,555	342,251	489,685	460,333	464,988	5,119,817
Platt	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,676	5,448	41,236	13,198	11,296	.....	.....	.....	73,844
Primrose	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,040	.....	.....	.....	6,040
Prince of Wales (A)	.....	.....	.....	.....	.....	.....	.....	.....	32,415	.....	.....	.....	.....	.....	.....	.....	.....	.....	32,415
Princeton (Sw'nz'y)	126,239	13,730	3,557	.....	8,328	2,842	.....	.....	.....	7,301	29,403	19,096	.....	6,593	.....	.....	25,247	55,802	298,138
Quarts	.....	.....	.....	.....	.....	.....	.....	491	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	491
Queen (A)	.....	.....	.....	.....	.....	.....	5,527	66,122	109,217	.....	.....	.....	.....	.....	.....	.....	.....	.....	180,866
Queen Group	.....	.....	.....	.....	.....	.....	.....	.....	.....	479,509	379,719	106,864	220,298	160,817	323,057	239,774	61,022	342,978	2,314,038
Republic	1,662,508	152,565	277,757	250,835	241,161	220,624	235,062	287,390	220,065	191,127	167,991	64,195	105,719	174,027	127,360	124,342	140,312	137,085	4,780,125
Repub. Reduc. Co	.....	.....	.....	.....	.....	87	21,050	22,122	3,915	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,174
Richards	.....	.....	.....	.....	.....	1,374	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,887	.....	.....	8,261
Richmond	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,088	4,630	24,464	4,613	34,795
Riverside	.....	.....	.....	.....	.....	.....	5,622	3,712	.....	6,783	.....	43	.....	.....	.....	.....	.....	.....	16,160
Rolling Mill	221,977	1,528	1,820	3,437	4,403	1,058	402	.....	.....	.....	.....	.....	.....	.....	.....	3,975	.....	.....	238,600
Saginaw	437,050	9,108	946	.....	.....	8,823	.....	.....	.....	4,320	.....	.....	.....	.....	.....	.....	.....	.....	451,424
Salisbury (B)	280,086	17,028	26,629	29,503	51.667	48,304	74,947	72,449	85,798	.....	.....	.....	.....	.....	.....	.....	.....	.....	686,411
Sam Mitchell	.....	.....	.....	.....	8,823	8,411	546	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17,780
Samson (Argyle)	240,512	15,700	1,334	.....	1,133	.....	4,512	2,796	1,218	.....	600	.....	.....	.....	.....	.....	.....	.....	267,805
Schadt	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,261	.....	.....	.....	.....	1,261
Section 12	21,887	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21,887
South Buffalo (A)	.....	.....	.....	.....	.....	4,964	24,706	69,359	146,383	.....	.....	.....	.....	.....	.....	.....	.....	.....	245,412
Spurr	154,425	9,067	.....	.....	752	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	164,244
Star West (Wheat)	25,998	6,625	6,824	9,200	15,867	17,538	4,987	7,997	15,141	4,412	.....	.....	5,550	51,207	9,658	942	.....	6,716	188,662
Taylor	26,815	6,155	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32,970
Titan	1,778	13,128	19,411	23,340	13,865	16,003	2,846	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90,371
Volunteer	304,585	19,414	11,748	5,679	24,034	47,486	56,321	60,156	141,524	92,699	127,130	69,561	26,946	32,672	53,216	1,617	.....	29,983	1,104,771
Webster	4,443	.....	934	.....	6,229	2,054	.....	448	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14,108
West Republic	35,219	30,734	19,623	12,700	10,558	12,872	9,861	1,510	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	133,077
Wetmore	1,777	2,777	4,585	5,887	10,756	3,335	2,074	19,679	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,870
Wheeling	.....	.....	4,098	6,383	.....	74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10,555
Winthrop	.....	.....	.....	.....	.....	.....	.....	.....	109,576	122,042	191,658	180 071	134,365	119,120	150,496	106,894	122,592	171,318	1,408,132
Total	17,428,708	1305,425	1558,034	1430,422	1627,380	1851,634	1923,727	2642,813	2993.664	2512,242	2666,856	1835,893	2059,330	2097,838	2604,221	2715,035	3125,039	3757,010	56,135,271
Mesabi Range.																			
Adams	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,141	234,562	170,738	390,860	720,474	1,575,775
Aetna (Lowmore)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,645	.....	.....	17,723	.....	.....	.....	19,368
Auburn	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	108,210	376,970	131,478	175,263	235,630	385,992	1,413,543
Biwabik	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	151,560	90,048	247,069	242,565	427,464	383,180	553,836	2,095,662
Canton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24,416	213,853	359,020	16,261	.....	.....	99,498	713,048
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26,372	.....	17,187	57,324	32,912	.....	246	134,041
Cloquet (Vega)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,628	47,700	96,280	12,215	.....	1,621	163,444
Commodore	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65,137	7,213	.....	22,063	60,798	80,494	152,947	388,652
Day	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,651	1,976	20,626
Duluth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,626	.....	.....	.....	.....	112,155	165,435	315,216
Elba	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	564	.....	9,547	10,111
Fayal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136,601	248,645	642,939	575,933	1072,257	2,676,375
Franklin	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46,617	223,399	286,423	231,086	30,128	200,400	60,000	1,078,053
Genoa	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17,136	309,514	279,677	276,559	882,886
Hale	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,616	24,167	31,004	70,006	13,728	.....	18,807	161,328
Kanawha	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14,963	14,963
Lake Superior	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58,123	67,659	259,912	135,404	154,326	675,424
Mahoning	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	117,884	167,245	519,892	520,751	750,341	2,076,113
Malta	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,615	28,615
Minnewas	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,858	2,140	.....	.....	.....	.....	.....	15,998
Mtn. Iron (& Rath)	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,245	119,818	573,440	371,274	142,021	773,538	650,955	1137,970	.....	3,773,261
Norman	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34,909	93,392	77,523	101,077	110,141	.....	.....	421,132
Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,943	69,925	47,350	101,607	293,651	.....	541,476
Oliver (I)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	123,015	505,955	509,377	808,291	601,072	349,100	.....	2,887,810
Penobscot	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,933	29,652	85,619	127,204
Pillsbury	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	99,691	106,487	206,178
Roberts	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,614	.....	57,847	76,461
Saintry	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53,004	53,004
Sellers	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,433	153,037	.....	112,765	174,867	488,102
Spurta	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	66,722	226,156	237,143	530,021
Williams (N. Cin'ti)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,046	11,249	.....	.....	12,357	26,652
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,245	613,620	1793,052	2781,587	2882,079	4275,800	4613,766	6626,384	23,590,542	
Miscellaneous	.....	.....	1,879	441	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,320

A—Now Queen Group. B—Now Iron Cliffs. K—Under Cleve'd-Cliffs I. Co. after '95. I—Mesabi Mtn. and Lone Jack. C—1893 and later in Winthrop. D—Ch

NAME OF	
Menominee	
Antoine	
Appleton	
Aragon	
Armenia	
Beta	
Breen	
Brier Hill	
Bristol (G)	
Calumet	
Chapin	
Columbia	
Commonwe	
Cornell	
Crystal Fall	
Cliff	
Cundy	
Curry (F)	
Cyclops (F)	
Delphic	
Deber	
Dunn	
Emmett	
Fairbank	
Florence	
Great Weste	
Groveland	
Half and Ha	
Hamilton	
Hemlock	
Hersel	
Hiawatha	
Hilltop	
Hollister	
Hope	
Indiana	
Iron River (	
Keel Ridge	
Lamont (Mc	
Lee Peck (I	
Lincoln	
Loretto	
Ludington	
Manganate	
Mansfield	
Mastodon	
Metropolita	
Michigan Ex	
Millie (Hew	
Nanaimo	
Northweste	
Norway (F)	
Paint River	
Penn Iron M	
Perkins	
Perry	
Pewabic	
Quinnesec	
Riverton	
Selden	
Sheridan	
South Masto	
Stephenson	
Sturgeon Riv	
Vulcan (F)	
Walpole	
Youngstown	
Total	
Vermillion Ra	
Chandler	
Minnesota	
Pioneer	
Savoy	
Zenith	
Total	
Gogebic Rang	
Ada	
Anvil	
Ashland	
Atlantic	
Aurora	
Bessemer	
Blue Jacket	
Brotherton	
Cary (and Su	
Chicago	
Colby (E)	
Comet	
Dareka	
Father Henn	
Federal	
First Nationa	
Germania	
Imperial	
Iron Belt	
Iron Chief	
Iron Chief N	
Ironton	
Jack Pot	
Kakagon	
Mikado	
Minnewawa	
Montreal	
New Davis	
Newport	
Nimikon	
Norrie	
Odanah	
Pabst	
Palms	
Pence	
Ruby (Purita	
Section 33	
Shores	
Sparta	
Sunday Lake	
Superior	
Tilden	
Trimble	
Tyler's Forks	
Valley	
Windsor	
Total	
GRAND TOTA	

NAME OF MINE.	Prior to 1853	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	TOTALS.
Menominee Range.																			
Antoine														27,931	110,821	98,847	104,510	93,025	435,134
Appleton														2,107					12,102
Aragon								1,745	46,609	96,829	167,948	127,901	138,209	183,296	95,809	149,594	295,821	337,807	1,641,568
Armenia								50,276	26,649					2,045					78,969
Beta					1,585	1,226				1,400									4,211
Breen	17,430																		17,430
Brier Hill	10,583	4,388																	14,961
Bristol (G)											57,352	9,612						80,915	147,879
Calumet	5,847	29,239	3,627																38,713
Chapin	416,583	265,830	290,972	157,455	198,871	336,128	290,871	518,980	742,843	488,749	660,052	489,134	235,895	618,589	420,318	643,402	724,768	940,513	8,439 963
Columbia	15 948	4,334	6,774		14,282	2,377	10,936	11,385	60,133	70,770	57,682	22,426	10,300	70,967	87,202	24,623	14,199	126,290	610,528
Commonwealth	222 915	21,493	34,622	42,947	51,189	56,609	61,818	108,515	116,786	134,982	249,113	151,291	174,921	208,880	93,707	98,283	250,687	117,295	2,196,053
Cornell	42,672				4,566	2,064													49,302
Crystal Falls	1,341								3,974					13,037	44,536	95,210	128,233	147,346	433,667
Cuff																		20,210	20,210
Cundy															3,395	41,942	76,877	100,902	223,116
Curry (F)	65,562	3,676	10,079	4,597		5,376	28,722	72,162	100,681	125,773									416,928
Cyclops (F)	97,485	22,675	24,099	49,897	37,189	14,297	14,693	6,101	7,361	10,599	1,697								286,093
Delphic		3,410	508	9,880	17,648	2,272									52				33,770
Dober																	5,008	10,980	15,989
Dunn						24,677	118,096	151,828	156,963	162,721	133,666	58,590	24,538	90,885	47,081	31,962	49,381	7,458	1,056,946
Emmett	66,655																		66,655
Fairbank	8,045	455																	8,500
Florence	274,799	40,232			8,210	79,399	142,585	196,269	218,570	48,806	48,246	9,634	2,726	22,820	35,136	37,594	93,663	74,235	1,332,924
Great Western	587	22,825	20,710		22,267	23,239	21,860	38,454	72,546	62,464	87,487	661			14,643		33,851	43,316	464,910
Groveland										1,049									1,049
Half and Half								5,961	1,496	67									7,524
Hamilton					872	600	8,801	8,347	17,072	58,197	2,183								96,072
Hemlock										35,531	65,459	11,323		949	94,645	96,032	69,865	110,289	484,073
Hersel									955										955
Hiawatha												1,683		1,201					2,884
Hilltop																		3,496	3,496
Hollister									2,020	1,057	1,021								4,098
Hope											15,543	2,275							17,818
Indiana	4,280	4,362	636	2,739	5,854														17,871
Iron River (H)	29,115	100,369	52,584	55,693	78,591	83,018	110,000	179,238	155,458	59,345	1,176								904,587
Iron Ridge	54,432	5,033									5,997	3,298		19,441				4,900	93,101
Lamont (Monitor)								12,348	31,139	26,226	42,819	13,777	2,900					67,652	196,561
Lee Peck (D)										1,813	2,844								2,844
Lincoln											26,019	8,757						43,622	80,211
Loretto												8,131	35,983	53,160	34,384	54,104	68,447	64,824	338,983
Ludington	64,342	102,632	101,165	124,194	74,454	101,653	61,883	116,297	97,355	141,303	15,777	109	354						1,001,518
Manganate									6,844										6,844
Mansfield									18,303	49,836	68,259	69,558				37,182	60,739	86,607	391,484
Mastodon	3,477	18,577	18,187	11,737	41,640	48,794	51,463	63,511	66,526	45,370	9,150	23,485		23,733	60				425,708
Metropolitan	23,854	36,643	27,577		6,393	9,070	3,490												107,027
Michigan Explo. Co.												505	77	1,071		216			1,869
Millie (Hewitt)	13,852	7,516	7,927	4,627	5,517	1,163	11,124	12,274	39,232	5,889	6,780		13,062	10,924	21,815	10,374	17,430	15,194	204,700
Nanaimo	2,480	29,221	37,620		5,400	30,460	5,744		3,441	13,200									127,566
Northwestern		7,302	10,004																17,206
Norway (F)	581,584	114,836	71,710	67,741	93,578	35,726	87,290	68,044	61,717	4,089	44,767								1,291,352
Paint River	6,515	5,973	11,652	2,573	13,933	10,240	12,506	32,700	62,651	45,435	18,390								222,371
Penn Iron M'ng Co.												280,450	175,274	290,622	179,917	237,886	223,713	229,651	1,617,513
Perkins	196,715	76,514	38,120	18,020	12,852	10,834	16,684	12,354	11,971					2,161					397,225
Perry		3,138																	3,138
Pewabic									26,991	64,507	115,273	165,745	304,010	262,551	273,587	279,855	305,072	530,129	2,327,720
Quinnesec	28,266	21,676	16,995	14,110	13,442	6,585	2,249							761				11,050	295,134
Riverton																		2,262	2,262
Salden					790	1,302													2,092
Sheridan								1,102	595	7,137	45,745	2,234		16,754	3,419	146		31,104	108,236
South Mastodon							2,722	4,005	1,476										8,203
Stephenson	34,743				1,018	3,589													39,350
Surgeon River						6,829	7,800	4,775											18,404
Vulcan (F)	366,659	79,874	101,722	124,125	143,930	205,036	129,541	153,900	101,996	78,967	179,904								1,668,654
Walpole						1,740	900	9,614	2,940	3,895									19,089
Youngstown	6,198	15,292	8,344		25,635	34,418	12,698		44,460	3,705				13		661			151,425
Total	2,842,974	1,047,415	895,634	690,435	880,006	1,193,343	1,191,101	1,796,754	2,282,237	1,824,619	2,261,499	1,466,197	1,137,949	1,923,798	1,560,467	1,937,013	2,522,265	3,301,052	30,754,758
Vermilion Range.																			
Chandler							454,612	306 220	336,002	373,969	651,655	435,930	558,050	605 024	471,545	438,365	715,919	808,359	5,755,650
Minnesota			62,124	225,484	304,396	394,252	57,341	535,318	532,000	517,570	498,353	370,303	390,463	432,760	448,707	592 196	426,040	457,732	6,645,039
Pioneer								3,144	12,012	3,079	2,651			40,054	149,073	207,103	123,183	339,897	880,196
Savoy																		86,191	86,191
Zenith											14,991	14,388			18,765	40,817		79,323	168,284
Total			62,124	225,484	304,396	394,252	511,953	844,682	880,014	894,618	1167,650	820,621	948,513	1,077,838	1,088,090	1,278,481	1,265,142	1,771,502	13,585,360
Gogebic Range.																			
Ada																		7,977	7,977
Anvil						10,075	24,676	47,000	45,690	73	42,090		13,297	68,064	57,483		5,037		313,485
Ashland				6,741	74,015	175,563	174,183	257,915	435,949	267,439	231,896	66,067	83,020	126,096	91,149	111,625	123,208	154,615	2,379,481
Atlantic						1,369								70,989	60,727	50,307	38,058	19,964	241,414
Aurora				5,422	94,553	159,252	179,937	199,865	246,695	83,554	319,482	179,028	203,152	245,883	187,169	166,122	133,076	170,369	2,573,559
Bessemer					4,788	16,101													20,889
Blue Jacket						1,799													1,799
Brotherton					8,880	21,721	40,639	53,267	80,486	46,574	130,833	18,905	47,148	40,587	50,490	46,186	73,198	78,858	737,752
City (and Superior)								56,542	116,203	121,186	106,484	28,578	16,559	52,349	38,821	37,308	43,162	62,524	679,716
Chicago															504				504
Colby (E)			1,022	84,302	257,432	258,518	285,880	136,833	193,038	9,619	69,968	59,346	32,616		48,492	22,921	152,875	103,239	1,716,101
Comet									2,882	10,144	54,779	9,604	11,782					322	89,523
Eureka									23,794	13,907	10,655	31,385	18,329	26,105	4,544				128,719
Father Hennepin							28,721	76,545	63,903	15,759									184,928
Federal									21,150	6,778									27,928
First National						1,997													1,997
Germania				5,468	19,734	61,714	53,918	103,169	52,000	22,383	4,283	7,964				1,015			331,648
Imperial											8,515								8,515
Iron Belt							30,000	51,551	110,368	1,506	161,635	23,976	45,100	148,228	81,351	96,763	58,418	105,334	914,839
Iron Chief					9,950	2,249													12,199
Iron Chief No. 2					551														551
Ironton					18,424	24,762			8,635	6,247	300								58,368
Jack Pot											3,944	1,651				1,265			6,860
Kakagon					18,497	52,179	1,228												71,904
Mikado																			
Minnewawa														4,788		11,397		10,324	26,509
Montreal																		1,255	1,255
New Davis					23,013	43,989	38,015	42,724	16,728	70,108	58,728	34,296	46,037	138,882	131,531	191,106	270,776	153,307	1,259,243
Newport									1,497		21,754	15,210		10 253				5,029	53,743
Nimikon					20,184	75,660	69,145	36,987	71,488	105,606	165,962	109,718	150,392	157,821	142,369	150,979	196,953	263,711	1,716,975
Norrie					4,105	23,217	1,313												28,635
Odanah				15,419	124,844	237,254	412,196	674,394	906,728	758,572	985,216	472 062	621,608	738,480	329,068	604,281	700,990	714,609	8,295,781
Pabst					13,714	30,475	5,412	13,354	1,065		6,711	3,959	2,437						77,124
Palms				1,103	17,979	19,906	49,976	116,376	172,060	130,226	113,245	104,510	206,074	219,960	68,984	220,486	223,891	263,809	1,928,655
Ponce						1,414	9,725	35,245	50,604	32,227	102,382	2,658	37,911	46,965	114,108	207,153	175,925	154,705	971,022
Ruby (Puritan)							26,687	574							13,185	120			40,566
Section 33					16,388	45,000	3,058	9,472	11,694	913									86,525
Shores								73,370	126,963	38,576	14,681								253,590
Sparta															12,196	16,102	15,691	11,819	55,808
Sunday Lake				1,405	10,963	18,137			6,010	64,902	56,046	22,876	34,323	20,970	89,441	45 815			4,862
Superior					2,680	27,763			36,675	10,710	13,192		30,597					12,526	383,414
Tilden										28,415	233,356	135,118	209,077	418,188	250,205	276,890	287,203	500,830	121,627
Trimble					10,780	12,764	2,387												2,339,282
Tyler's Forks									10,683										25,931
Valley					1,878														10,683
Windsor								14,576	37,210	97	53,242	2,474		11,438	28,154	385			1,878
Total			1,022	119,860	753,362	1322,878	1437,096	2008,394	2847,810	1839,574	2971,991	1329,385	1809,468	2,547,976	1,799,971	2,258,236	2,498,461	2,795,856	28,341,340
GRAND TOTAL	20,271,682	2352,840	2518,693	2466,642	3565,144	4762,107	5063,877	7 292,643	9003,725	7071,053	9072,241	6065,716	7748,312	10.429,037	9,934,828	12,464,574	14,024,673	18,251,804	152 359,591

Throp. D—Cherry Valley Ore. E—Includes Tilden up to 1891. F—1893 and later under Penn Iron Mining Co. G—Formerly Claire. H—Now Riverton.

THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. FEBRUARY 1, 1900. CHICAGO, ILL. NUMBER 5

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Quiet and generally firm is still the condition of the iron trade in its length and breadth. Pig iron selling centers, particularly Cincinnati and Chicago, note increased activity. It is not general enough, however, to be called a movement, and it is remarked that inquiries are much more numerous than sales. But it is significant that a good many foundry buyers are feeling the market and that some have made considerable purchases for the first half of the year. We hear of concessions of 25 cents on some of this business, from the quotations that have been maintained for a number of weeks; but the inside prices are still the exception and producers of standard brands, with orders booked that will take most of their scheduled output to July 1, are quoting as before. It would seem that no long time will be required to show clearly how the situation will shape itself for the second quarter. Reports of poor working of furnaces are heard here and there. Three valley stacks made smaller outputs in January than in December, and perhaps due consideration has not been given in the calculations for increased output to the fact that every nerve was strained last year to attain the highest tonnage, and that not a few furnaces have been kept going beyond the time at which repairs would ordinarily be made. Other furnaces were put in blast hurriedly to get the benefit of the profitable prices, some of them with only sufficient repairs for a short campaign. That interruptions to both these classs of furnaces will come this year is a probability to be reckoned with. The coke trouble has eased to the extent of a better supply of cars, but the urgency of demand is advancing the price, and there are furnaces as well as foundries, that have not as good assurance as they would like, of a steady supply in the next six months. Some of the iron buying of the week was by the leading cast iron pipe interest, which has been holding off in expectation of lower prices. The purchase was only for several thousand tons, indicating a hand-to-mouth policy for the time being. The two leading consumers of mill iron have been buying in the same way on a firm market. Sales of Bessemer iron continue, showing how closely steel works companies are at the heels of Bessemer furnaces. Pitsburg reports 30,000 tons sold the past week at the equivalent of $24, valley furnace. The deadlock in steel has not been broken, but the number and amount of inquiries are large, pointing to considerable business in the near future. There is no question that a large tonnage could be closed at once, at some concessions from the $35 basis, but the probability now seems greater that that is the basis on which business will be done. The finished lines show firmness, apart from the weakness in plates. Much has been made in dispatches, of the competition between plate mills, but this is not a new situation. Capacity has been growing gradually and business has been pushed for in a way unknown in months preceding. The mills better supplied with work are not meeting the lowest prices. While 2.25c, Pittsburg, has been done of Bessemer tank steel, prices on open-hearth have ranged from 2.35c to 2.45c. The sheet mills are even firmer than was indicated one week ago, and with the largest producers the advance since Jan. 1 amounts to $4 a ton. The outlook for structural material continues excellent, both for railroad and architectural work. Chicago reports additional car contracts now under negotiation, one road being likely to place orders for 7,500 cars, while car works are booked for months ahead. The British iron market has been advancing in January, and the possibility that manufactured exports from that quarter may be less this year by the diversion of men to the war, suggests an increasing call for the products of the United States. There is some inquiry for Southern pig iron for export, and moderate sales have been made recently.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
705 PUBLICATION BUILDING, Jan. 31.

Any doubts that "may have" existed concerning the maintenance of the present prices of pig iron have been dispelled by the sales here of 30 000 tons of Bessemer in the past week at $24, at Valley furnace. Sales of 7,000 tons of gray forge, valley, at $21.25 and $21.50, are also reported. The Bessemer iron is for delivery from February to August, inclusive. In view of these sales, which are the largest noted in this district this year, the steel maket shows no indication of easing off, and while only a few sales of billets in small lots are reported, the inquiry is better than it has been for some time. There is a slight weakening in the price of tank and boiler plates, with a few small sales and little inquiry. Sheets are firmer than a week ago. Manufacturers are not anxious to book orders many months ahead owing to the efforts that are being put forth to bring about a consolidation. The date now fixed for the consummation of the deal is April 1, but nothing definite can be learned about the progress made up to date. The scarcity of coke continues, but it is reported that the railroad companies have placed more cars at the disposal of the shippers during the past week than for some time.

PIG IRON.—The market for forge and Bessemer is as strong as ever. The prevailing prices have been successfully maintained in the sales noted above and from the large number of inquiries for iron for delivery in the first half, there is no indication that the market will go lower. The foundrymen are still holding off. Sales of several hundred tons of No. 2 foundry in small lots are the only transactions reported. In these the quoted prices were obtained. Small lots of special No. 2 foundry have been sold at $23.50 and $24, but that is not the general market. We quote as follows:

Bessemer, valley furnace	$24.00	to	$24.35
Bessemer, Pittsburg	24.90	to	25 25
No. 1 Foundry	23.75	to	24.00
No. 2 Foundry	23.00	to	23.25
No. 3 Foundry	22.25	to	22.50
Gray Forge, valley furnace	21 50	to	21.75
Gray Forge, Pittsburg	21.50	to	21.75

STEEL.—Only a few small sales of steel have been reported here during the past week. Consumers, while not showing any great disposition to buy, are making inquiries, and it is believed that large purchases will be made before many weeks. There has also been some inquiry for the export

trade, but no sales reported. The market is firm, and remains unchanged. We quote $35 for 4x4 billets and $36 for slabs and small billets at mill, Pittsburg, Wheeling or valley. Sheet bars continue firm at $36 mill.

FERRO-MANGANESE.—We continue to quote $125 for domestic 80 per cent.

RAILS AND TRACK MATERIAL.—While sales of rails have been reported in the West and East during the past 10 days, no contracts have been placed here, and the mills are working on orders closed several months back. Our quotations follow: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts square heads, 3.60c; hexagon heads, 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 10c.

SPELTER.—There has been another advance in spelter during the past week, and prime Western grades are strong at 4 65c to 4.70c, Pittsburg.

SKELP.—The market continues quiet. Grooved iron is quoted at 1.95c to 2.05c, and grooved steel 2.05c to 2.10c. Sheared iron, 2.25c; sheared steel, 2.10c to 2.25c.

MUCK BARS.—The market is firmer. A sale of 1 000 tons of muck is the largest transaction reported here for some time. This was made at $33.50, while one of the largest manufacturers quotes $34 straight. However, it is stated, that $33, Pittsburg, can be done on forward deliveries.

BARS.—Steel bars continue firm despite limited new sales and only a few inquiries. The minimum in this district is 2 25c. There is no change in iron bars. Refined are quoted at 2.40c, Pittsburg, and common iron bars at 2.15c, valley.

STRUCTURAL MATERIAL.—The indications for an excellent year's business are brighter with every week among the structural iron manufacturers and bridge builders in this district. The Baltimore & Ohio Railroad has presented specifications to bridge builders for a double track bridge across the Ohio river at Bellaire, O. The Virginia & Southern Railway Co. has asked for bids for building four bridges on the extension in Carter county, Tenn. The commissioners of Fayette county are soliciting terms for the erection of a suspension bridge across the Youghiogheny river, between Connellsville and New Haven. A number of foreign specifications for bridge work have also been received. We quote the market unchanged as follows: Beams and channels 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees, 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order.

PIPES AND TUBES.—The demand continues good, with numerous sales in small lots. Additional capacity will be put into operation in the next week or 10 days. We quote the market as follows: Merchant pipe, 50 and two 10's for car loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron and 55 per cent off for steel, 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—With the demand for plates limited, the market is easier than for some time. Tank plate, assorted widths, is quoted as low as 2.25c, with a slight advance for extreme widths, but all mills are not making the lowest quotations. We quote shell steel at 2.60c to 2.70c; flange, 2.70c to 2.80c; fire box, 3¼c to 4c.

SHEETS.—The sheet market is now quite firm. A number of mills ask 3.10c to 3.20c for No. 28 gauge, one pass through cold rolls. This is not the market price, however, as the bulk of business for the next two months is being placed at 3c to 3.10c. Iron sheets are 5c less. Owing to the impending consolidation the sheet manufacturers do not care to book orders too far in advance and it is said that this is the cause of the higher quotations. Galvanized continues strong, with mills quoting 75 and 5 and 75 and 7½. The usual 15-cent freight allowance is given.

OLD MATERIAL.—There is not much demand for old material and quotations remain unchanged as follows: New basic melting stock, $30 to $32; new Bessemer melting stock, $23.50 to $25; basic open-hearth scrap, $31 to $33; steel rails, mixed lengths, $22 to $23; short lengths, $23.50 to $24; iron rails, $29 to $31; cast borings, $14 to $15, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $24 to $25, net tons; busheling scrap, $16 to $18, net tons.

COKE.—Despite the fact that the railroad companies have placed more cars at the disposal of the coke shippers during the past week than for some time, the foundries and furnaces are unable to get any considerable stock ahead. It is feared that the present severe weather will interfere with shipments to some extent. Furnace coke is selling in the open market at $3.25 to $3.50, while foundry coke is held at $3.50 to $4, with very little to be had. It is believed that the firing up of a number of ovens in the Monongahela district within the next 30 days will better the situation to some etxent.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Jan. 30.

A considerable business was done last week in both iron and steel, and the demand appears to be increasing with every week. There is a very large amount of business in sight, including several large contracts, and it is expected that the bulk of it will be placed within the next few weeks. The market continues very firm no concessions being made by mills and furnaces in this district.

PIG IRON.—Sales last week were quite a little larger than the week previous, and included several good sized orders, one of a round lot of Southern iron having been taken. The demand is much better, and there are a number of good contracts in sight. The United States Cast Iron Pipe & Foundry Co. is in the market for a round lot of Southern iron, and will likely place its order some time this week for a considerable tonnage. The demand from smaller buyers keeps up well, although some of the local foundrymen are holding off in the belief, or rather hope, that prices will recede to some extent, and they can buy at lower figures later than now. The furnaces are all behind on their orders, and are selling iron about as fast as they make it, and are consequently very strong in their views, and say there is no possibility of lower prices as long as present conditions prevail. There is still a decided shortage in coke, both in furnace and foundry grades, and this is causing considerable trouble in getting out orders for castings. Local foundries are all running full, and many complaints are heard that furnaces do not ship as fast as iron was contracted for. The market is unchanged as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	22 85 @ 23 85
Local Coke Fdy. No. 2	24 50 @ 25 00	Southern No. 2 Soft	21 85 @ 22 85
Local Coke Fdy. No. 3	24 00 @ 24 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	32 00 @ 32 50
Local Scotch Fdy. No. 2	24 50 @ 25 00	Ohio Strong Softeners	24 50 @ 25 00
Local Scotch Fdy. No 3	24 00 @ 24 50	Alabama Car Wheel	24 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	25 00 @ 26 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—The demand is excellent, although mostly for comparatively small lots. There were several quite good sized contracts closed last week, however, and further large business is in sight. The market is unchanged at 2.30c for iron and 2.35c for soft steel, half extras, Chicago.

CAR ORDERS.—There are a number of good orders for cars in the market and roads are experiencing some difficulty in getting them placed. It is reported that the Wabash is in the market for 7,500 coal and gondola cars. The call for car material on new contracts is not especially large, with the exception of axles, for which numerous inquiries have been received. Car works seem to have provided for all the business they are taking, in most respects.

RAILS AND TRACK SUPPLIES.—The sales of the week were not large or important. The local mills report a fair demand for small lots of both light and standard sections. Quotations are as follows: Rails, standard sections, $35 to $38; light sections $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.75c to 2 85c; track bolts, 3.65c to 3.85c.

BILLETS AND RODS.—There is a considerable demand for both billets and rods, but all the business placed here is taken by mills farther East, as the local mills are practically out of the market. Bessemer billets are quoted at $35 and sheet bars at $36, Pittsburg, with $2 added for Chicago delivery. Open-hearth rods are quoted at $65 and Bessemer at $55, by Central Western mills.

PLATES.—The demand is excellent, and sales last week were quite in excess of those of the week previous, both from

mill and from store shipment. Most of the orders are for comparatively small lots. The market is weak, and lower prices than those we quote are heard, and undoubtedly are made by some mills, but these fairly represent the market. We quote tank steel from store 3.10c to 3.20c. Mill shipments, Chicago delivery: Tank steel, 2.60c to 2.70c; shell, 2.70c to 2.80c; flange, 2.80c to 3c; marine, 3c to 3.10c; firebox, 4c to 6c, according to brand.

STRUCTURAL MATERIAL.—General business in small lots was good last week, but no large contracts were closed. There is a large tonnage in sight, both for bridge and building work, and it is expected a portion of this, at least, will be closed soon. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 2.65c to 2.75c; universal plates, 2.75c to 2.80c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

SHEETS.—The demand improves every day, and sales last week were in excess of those of the week before. Galvanized sheets are in especially good call, and sales last week included several quite large lots. The market is very firm. Black sheets are quoted at 3c to 3.15c for No. 27 black, and galvanized at 75 to 75 and 5 per cent off.

MERCHANT STEEL.—The situation is unchanged. The demand is almost entirely for small lots for store shipment. very few mill orders having been received. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Orders were confined to small lots for immediate delivery. Quotations are unchanged at 50, 10 and 5 off for small orders, and 50, 10 and 10 off for large orders, mill shipment.

WIRE AND WIRE NAILS.—The demand is very large and sales have been excellent and give every promise of continuing so. The largest producer reports the outlook very good for a continuance of the present demand, and that it is much more likely to increase than diminish. Quotations are firm and unchanged. Makers quote single carloads of wire nails at $3.53, f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—Sales have been limited to small lots in nearly every instance. The demand is light and stocks are large, so that the market, with a few exceptions, is not at all strong. Dealers, however, are not making concessions to secure business. Quotations are now about as follows:

Old iron rails, gross,	$25 00@$26 00	Country malleable	$14 50
Old steel rails, long, gr.	23 00	Iron axles, net	$27 00@28 0
Old steel rails, mixed	19 00@ 19 50	Cast borings, net	10 00@11 00
Relaying rails, gross	28 00@ 30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	24 00@ 24 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@ 17 00	Mixed country steel, gr	14 00
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@ 15 00	Heavy melting steel, gr	18 50@19 00
Railway malleable, net	16 00	Old iron splice b., net	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., Jan. 31.

Further sales of comparatively small lots of ore of 1900 production have been made in the past week and there is better assurance with each week that the output of this year will all be needed—that of old range Bessemer ores in particular. Dock stocks of unsold ore are now down to the smallest proportions in years—200,000 tons being shown by the statistics of the first of the present month. As given in detail elsewhere, the completed statistics of Lake Superior iron ore shipments in 1899 show a total of 18,251,804 gross tons. The bulk of the increase this year, it is expected, will come from the Mesabi range, which, if furnaces will increase their percentage of its ores to, say, 40, might ship 8,000,000 out of 20,000,000 tons in 1900.

PIG IRON.—The valleys have been making their contribution recently to the catalogue of obstacles to increasing production of pig iron. Three stacks, through accidents or poor working, have had their output curtailed in a way that will be evident in January statistics. Coke supply is not a whit improved. On foundry coke the usual price of $3.75 at the ovens, and for furnace coke fancy prices have been offered in some cases. The supply of Bessemer iron will be shortened for the time by the changing of one valley furnace to mill iron, but by the latter part of February one of the new Youngstown furnaces will be going. We continue to quote Bessemer at $24 at valley furnace. No activity is reported locally in foundry iron, though there is occasional inquiry. Valley mills are picking up mill iron as it can be had, but little is offered and $21.50 delivered is well maintained for Northern. For the Cleveland plant of the cast iron pipe consolidation some gray forge has been bought, but only a relatively short tiem supply. This purchase has been long delayed in an expectation of lower prices, which it is understood was not realized. We continue quotations unchanged:

Bessemer	$24 90	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@ 23 50	Valley Scotch No. 2	22 50@23 00
No. 2 Strong Foundry	22 50@ 23 00	Gray Forge, valley	21 50
No. 3 Foundry	21 50@ 22 00	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—A generally quiet week is reported, but there have been some developments as to prices that point to conditions likely to prevail when the active season opens two or three months hence. With all the quiet some important mills report as much business newly booked as went off the books in shipments. The plate market is still unstable. The weak prices that are still heard from appear to be chiefly on Bessemer tank steel, which has sold at 2.25c and 2.30c, Pittsburg. Sales of open-hearth tank have been made the past week at 2.40c to 2.50c, Pittsburg, the cut prices being mostly on narrower plates and by recently started mills. A Shenango valley plant has started its plate department after several years' idleness. The trade in wrought pipe has been unusually good recently and the early appearance of business is taken as indication that last season's experience may be repeated—mills being then utterly unable to supply the needs of consumers. Several considerable contracts in pipe have been made in the week. Sheet mills in some instances are filled for 90 days ahead, and prices have been advanced. Local quotations are based on 3.05c to 3.10c for No. 27 at mill, while on galvanized the discount is 75 and 5 to 75 and 2½, with 15-cent freight allowance. Bar iron and steel bars are quite firm, the mills being so far sold up as to preclude any early likelihood of a change in price. The consumption on railroad and car account is very heavy. We quote common iron at 2.15c, Valley mill, and steel at 2.25c, Pittsburg. There is figuring on a 1,000-ton rail requirement for an electric railroad extension.

CINCINNATI.

Jan. 29.

Sales of Southern pig iron during the past week have been fairly satisfactory, but they are only a small proportion of the inquiries received. Matthew Addy & Co. say: "A great deal of figuring was done last week without actual business resulting. Of course this means that buyers are uncertain and are not looking ahead except in cases of necessity. At least that is the rule, although it is not an absolutely general rule by any means. From a seller's standpoint this makes no difference at all. The majority of furnaces are sold solidly for months ahead, while many of them are several months behindhand on contract deliveries. This has been said before, but it is still true. Owing to bad weather this month and to labor troubles in the South the furnaces have not in that district succeeded in reducing in the slightest degree the tonnage due last year, but which was carried over into this year. The car situation is still exceedingly annoying."

Rogers, Brown & Co. say: "The business of last week was on a slightly expanded scale, as compared with the preceding week. While the orders have been principally for small quantities, several 1,000-ton lots have been booked. The transactions of the week perhaps comprehend an equal amount of Northern and Southern iron, and while the improved demand is not recognized as heavy, it is exceedingly encouraging, and based upon the best data obtainable is of the most healthy character. The urgency for shipments on orders already entered continues and gives positive proof of continued activity of the foundries and factories throughout the entire district."

We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge, $19.25 to $19.75; No. 1 soft, $21.75 to $22.25; No. 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23.50 to $24; Hanging Rock charcoal, No. 1, $25 to

$26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

Jan. 30.

The situation in pig iron is one of continued quiet and firmness. The long continuance of the waiting period gives a general impression of weakness, but we do not find the furnaces are making efforts to push sales. Buyers are making inquiries but in some cases only to keep track of the market, most of those who ask quotations being of opinion that nothing is lost by wating, though at the first sign of any general buying movement it is believed a considerable number would be in at once to make sure of iron yet unbought for the first half of the year. That here and there a 25-cent concession has been made because some new bidder on a contract of 1,000 tons or upward went below the general quotation and this was met by the seller whose iron has been regularly in use by the buyer, cannot be taken, it appears, as a gauge of the general market. The average buyer is going in only for small lots, and it is expected a good many will follow the market in this way for months to come. We see no reason to change the estimate heretofore sent that the situation is a firm one, with no prospect of an early change. We quote No. 1 foundry, standard brands, at $25 to $25.50; No. 2X foundry, $23.50 to $24.50; No. plain, $22.25 to $22.75; standard mill iron, $20.50 to $21. There is nothing new in billets and muck bar. In the latter the price is weak —$30 to $30.50, makers' mill, for standard brands. Buyers of billets still wait. Small lot business is done at $36 50, but buyers want to make contracts at $35. The finished material market gives more indication of activity, though the fact is that mills have been very fully engaged for some weeks. Plates are still the most uncertain factor, and mills are following up business quite closely. We quote 2.40c to 2.45c for tank plates delivered. The quotations of 2.35c at Eastern Pennsylvania mill, has been made on business for Western delivery. Bars are more active and are firm at 2.15c to 2.20c for refined iron and mills are reported to have their capacity well engaged for the next three or four months. The situation is quite satisfactory from the producer's standpoint. A good deal of business is evidently being held off, and it is now about an even prospect, as between steady prices and such a quickening of demand when spring opens, as shall cause advances in some lines. Buyers' expectations seem to be for a lower range of prices, but sellers, as a rule, are firm. We quote No. 27 sheets at 3.10c to 3.25c, with rather more firmness in the past week. In old material a better feeling appears in low-priced stock such as borings, turnings, machinery scrap, stove plate, etc. Steel melting scrap is bringing better prices also. We quote bids and offers as follows, delivered in buyer's yard, seaboard or nearby points: Choice railroad scrap, $23 to $25; No. 1 yard scrap, $19 to $21; No. 2 light scrap, $13 to $15; machinery cast, $18 to $18.50; heavy steel scrap, $21 to $22; old iron rails, $26 to $28; old steel rails, $22.50 to $23; wrought turnings, $15 to $16; cast borings, $13.50 to $14; old car wheels, $21.50 to $22.50; iron axles, $27 to $29; steel axles, $25 to $27.

With its February issue *Mines and Minerals*, Scranton, Pa., issues a supplement illustrating the steel head frame construction at nine Pennsylvania anthracite coal mines. Owing to the plentiful supply of timber, steel construction has been employed in only one or two cases at Lake Superior iron mines, but it promises to be in increasing demand.

Plate mill No. 10 of Jones & Laughlins, Ltd., was converted from a two-high to a three-high mill last week. The work was done in seven days, and on Monday morning, after a week's shut down, the mill was placed in operation again. The first of the company's 600-ton blast furnaces has already been blown in. The second furnace will be blown in April, the third next fall, and the fourth about Jan. 1, 1901.

Jupiter Furnace, at St. Louis, will be started up as soon as a supply of coke can be secured. It is proposed to use a mixture of Pilot Knob and Mesabi ores.

RECEIVED FROM THE TRADE.

The catalogue of James B. Clow & Sons, of Chicago, manufacturers of pipe and fittings, steam and water works supplies, and of gas and plumbing goods of all descriptions, has many features that will commend it to the busy buyer in these lines. It is a convenient and reliable guide in the lines it covers, and its completeness is almost encyclopedic. The size is 10x12 inches, the binding an attractive buckram and the 554 pages are profusely illustrated with well made cuts, printed on heavy paper. The volume is not confined to the manufactures of James B. Clow & Son, but includes in an impartial way the products of manufacturers in the East and the West. The systematic arrangement of the contents makes it possible to turn at once to any class of products, as generally embraced in a condensed index of 20 lines in the front of the book. Pipe of all kinds and metals comprise one department; fittings another; valves another; while engine and boiler trimmings, heating apparatus, gas fixtures, cocks, hose goods, packing, pumps, well goods, tools, water works supplies and the various subdivisions of plumbing goods are all carefully classified into the departments, each with its individualizing department letter. Aside from the condensed contents, the book is also carefully indexed. It is stated that the University of Illinois requested copies of this catalogue for use by its senior class in mechanical engineering. Copies may be had by addressing James B. Clow & Sons, 222 Lake st., Chicago, and mentioning this paper.

Bound in red cloth, 4¾x7 inches in size, and containing 80 pages of matter "The Ajax Red Book," the 1900 catalogue of the Ajax Mfg. Co., of Cleveland, gives illustrations and descriptions of the company's well known machines, besides details of some not found in the "blue book" which preceded it. The Blakeslee heading, upsetting and forging machines have first place in the book, these being illustrated, from the massive 6-inch machine, which makes forgings from stock 6 inches in diameter and from flats up to 14 inches width and 3 inches in thickness, down to the ¾-inch machine which handles stock up to ¾ inch diameter, and in addition rivets, bolts and upsets. All these machines have automatic stop motion. There are also illustrated the same company's bolt heading machines of various sizes, its solid die, hot rivet machine, forging rolls, bulldozing and bending machine nut machine, nut tapper, bolt cutter, etc. The Ajax bulldozer No. 12 when in operation exerts over 1,000,000 pounds pressure to the crosshead. Several pages of samples of work done on the various Ajax machines are given, and valuable tables of measurements, weights, etc., of nuts and bolts and bar iron.

Northern Engineering Works, crane builders, of Detroit, Mich., have issued a new edition of their crane catalogue No. 11, which will be sent on request. The company reports a large volume of crane work of all kinds in progress in its shop.

Randolph Brandt, 38 Cortlandt st., New York City, manufacturer of the "Selden" patent packing for stuffing boxes of engines, pumps, etc., is sending to the trade and others a vest pocket memorandum book with celluloid cover. In addition to a liberal allowance for memoranda it contains data for ready reference for the business man and engineer.

S. M. Pagan, of Philadelphia, who was announced last week as the winner of the $50 check offered by Rogers, Brown & Co. for the estimate on pig iron production in the United States in 1899 that should be nearest the official figures, is a salesman for a large tobacco house. His estimate was 13,620,000 tons, or 703 tons less than the actual production.

It is reported that the American Steel & Wire Co., which will concentrate its plants in the Pittsburg district on Neville island, is negotiating for the purchase of additional land on this island adjoining its present property.

The McKees Rocks plant of the Pressed Steel Car Co. was put into full operation during the past week. Work will be carried on both night and day. President Greatsinger, of the Duluth & Iron Range Railroad, has been in Pittsburg the past week negotiating with the Pressed Steel Car Co. for the building of 450 steel cars for the ore trade.

18,251,804 TONS OF LAKE SUPERIOR ORE.

Official Figures for the Output of 1899.

Direct reports from all the producing iron mines in the Lake Superior region make it possible to present complete statistics of the shipments of ore, mine by mine, in the year 1899. In but one year in the history of the region were more mines active than in the past year. In 1890, there were 96 producers as against 95 last year. The Mesabi range is by far in the lead in tonnage; it is also the leader in number of properties worked, shipping from 27 mines. The Menominee range had 26 active, the Gogebic range 20, the Marquette range 17, and the Vermillion range 5. Reckoning strictly by mines, the number operated in 1899 exceeds greatly that of 1890, for in several instances but one return is now made for properties operated by one interest, whereas each mine was returned separately in 1890. This is instanced in the Cleveland-Cliffs Iron Co., the Penn Iron Mining Co., Lake Superior group on the Mesabi range and others.

MARQUETTE RANGE.

Mine.	Gross Tons.	Mine.	Gross Tons.
Cambria	124,930	New York	6,642
Champion	215,074	Princeton	55,802
Cleveland Cliffs	1,011,048	Queen	342,978
Imperial	23,235	Republic	137,085
Jackson	88,230	Richmond	4,613
Lake Angeline	464,988	Starwest	6,716
Lake Superior	682,595	Volunteer	29,983
Lillie	196,200	Winthrop	171,318
Negaunee	195,573		
Total			3,757,010

MENOMINEE RANGE.

Antoine	93,025	Hemlock	110,269
Aragon	337,807	Hilltop	3,496
Bristol	80,915	Keel Ridge	4,900
Chapin	940,513	Lamont	67,652
Commonwealth	117,295	Lincoln	43,622
Columbia	126,290	Loretto	64,824
Crystal Falls	147,346	Mansfield	86,607
Cuff	20,210	Millie	15,194
Cundy	100,902	Penn Iron Mg. Co	229,651
Dober	10,980	Pewabic	530,129
Dunn	7,458	Quinnesec	11,050
Florence	74,235	Riverton	2,262
Great Western	43,316	Sheridan	31,104
Total			3,301,052

GOGEBIC RANGE.

Ada	7,977	Minnewawa	1,255
Ashland	154,615	Montreal	153,307
Atlantic	19,964	New Davis	5,029
Aurora	170,369	Newport	263,711
Brotherton	78 858	Norrie	714,669
Cary	62,524	Pabst	263,869
Colby	103,239	Palms	154,705
Comet	332	Shores	11,819
Iron Belt	105.934	Sunday Lake	12,526
Mikado	10,324	Tilden	500,830
Total			2,795,856

VERMILLION RANGE.

Chandler	808,359	Savoy	86,191
Minnesota	457.732	Zenith	79,323
Pioneer	339,897		
Total			1,771,502

MESABI RANGE.

Adams	720,474	Kanawha	14,963
Auburn	385,992	Lake Superior	154,326
Biwabik	553,836	Mahoning	750,341
Canton	99,498	Malta	28,615
Cincinnati	246	Mountain Iron	1,137,970
Cloquet	1,621	Ohio	293,651
Commodore	152,947	Penobscot	85,619
Day	1,975	Pillsbury	106,487
Duluth	165,435	Roberts	57,847
Elba	9,547	Sellers	174,867
Fayal	1,072,257	Sauntry	53,004
Franklin	60,000	Sparta	237,143
Genoa	276,559	Williams	12,357
Hale	18,807		
Total			6,626,384
Total all ranges			18,251,804

Adding in the production for 1899, the grand total from all ranges since the first shipments from the Marquette range 44 years ago, is now 152,359,591 tons. It is significant that the past four years' shipments, namely, those of 1896, 1897, 1898 and 1899 are equal to more than half the output of the preceding 40 years, being about 52,000,000 tons, against about 100,000,000 tons in the years 1855 to 1895 inclusive. It is entirely probable that the next five years' output will equal that of the first 40.

In the table below are given shipments by ranges and by ports, with all rail ore added. It will be noticed that the increase over 1898 is smallest in the case of the Gogebic range. In 1898 for the first time in 12 years the Menominee range exceeded it, and the lead was increased in 1899. It is evident that the Gogebic is least able of the older ranges to respond to the rapidly increasing call for ore:

SHIPMENTS BY RANGES.

	1897 Gross Tons.	1898 Gross Tons.	1899 Gross Tons.
Marquette Range	2,715,035	3,125,039	3,757,010
Menominee Range	1,937,013	2,522,265	3,301,052
Gogebic Range	2,258,236	2,498 461	2,795,856
Vermillion Range	1,278,481	1,265,142	1,771.502
Mesabi Range	4,280,873	4,613,766	6,626,384
Total	12,469,638	14,024,673	18,251,804

SHIPMENTS BY PORTS AND ALL-RAIL.

	1897 Gross Tons.	1898 Gross Tons.	1899 Gross Tons.
Escanaba	2,302,121	2,803,513	3,720,218
Marquette	1,945,519	2,245.965	2,733.596
Ashland	2,067,637	2,391,088	2,703,447
Two Harbors	2,651,465	2,693,245	3,973.733
Gladstone	341,014	335.956	381,457
Superior	531,825	550,403	878,942
Duluth	2,376,064	2,635.262	3,509.965
All-Rail	253,993	369,241	350,446
Total	12,469,638	14,024,673	18,251,804

The all-rail shipments for 1899, contrary to the general expectation, prove to be less than those for 1898.

Cost and Feasibility of Cupola Malleables.

TO THE EDITOR:

I have been interested in reading the articles of E. H. Putnam, published in your paper from time to time, in regard to making malleable castings with the cupola process. The last one in your issue of Jan. 25 is so misleading that it probably causes others who are engaged in the management of the shop as well as myself, a great deal of worry as to how we are to produce malleable castings with the present price of labor, iron and other material that entered into their manufacture, at a cost of less than 2½c per pound, as stated in the second paragraph of the article. I should be pleased to have Mr. Putnam publish the figures upon which he based his cost, starting out with pig iron and following with the other items which enter into the cost.

As articles of this kind are published, the employers of such men as myself undoubtedly hold these figures over their employes and wonder why it is that we cannot get men to work for nothing as would be necessary in this case, in order to produce malleable castings, such as are used in agricultural machinery, at a less cost than 2½c per pound.

I will state that for a term of 12 years I used a cupola in making malleable castings, but for the past 12 years have used the standard method of melting in a reverberatory or air furnace. Under no circumstances would I return to the old method of melting with a cupola; nor is there today any first-class manufacturer of malleable castings who pretends to use a cupola. As regards the matter of shrouding the manufacture of malleable castings in mystery, the process is open to any one, and the margin of profit is so low that people who are actually acquainted with the cost of making castings are in no hurry to rush into the business. As with all other lines of business, the one may to manufacture and realize a profit is by giving strict attention to all of its details.

St. Charles, Ill. P. H. DAVIS.

Messrs. Chas. H. Besly & Co., 10 and 12 N. Canal st. Chicago, manufacturers and dealers in machinists' hardware, report a very successful business for the year 1899, a marked improvement being noted in the demand for specialties of their own manufacture, viz., taps of all descriptions, Badger and Gardner die stocks, parallel clamps, Helmet sheet bronze and wire for springs, Perfection and Bonanza oil cups, Gardner grinders, Helmet solid oil, and Mannocitin, a rust preventive. Business for the new year has started in well and they regard the outlook for the future very bright.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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FEBRUARY 1, 1900.

THE index for Vol. XXXII of *The Iron Trade Review*, taking in the issues of the year 1899, will be ready within the coming week and will be sent to all subscribers who make request for it.

IT is noteworthy that the production of charcoal pig iron in the United States in 1899 was less than in 1898—284,766 tons, against 296,750 tons. The consumption was sufficient, however, to take up practically all the stock of charcoal pig that was on hand at the close of 1898. With the rapid advance in the price of coke iron the charcoal product was put more easily on its old footing of preference, the difference in price not being sufficient to secure the substitution of coke iron to the extent noticeable in the preceding four or five years. There is no likelihood of any stimulus to charcoal furnace building, however, and the furnaces now going are likely to enjoy a period of profit making for some years.

IRON AND STEEL EXPORTS IN 1899.

Advance sheets sent out in the past week give the summary of the iron and steel export trade of the United States in the twelve months ending Dec. 31, 1899. The $100,000,000 mark indicated near the close of the year was passed, the total for all forms of iron and steel and for machinery of all descriptions being $105,689,645. This is a marked increase over the $82,771,550 total in 1898 and $62,737,250 in 1897. The higher values of 1899 are in evidence in the export showing. For example, the 228,640 tons of pig iron sent to foreign markets last year was valued at $3,281,425, as against $2,547,252 for 249,357 tons, or more than 20,000 tons more, exported in 1898. Other interesting items are the following: Steel billets and blooms, 25,605 tons, against 28,600 tons in 1898; structural steel, 54,244 tons valued at $2,059,289, against 34,038 tons valued at $1,255,451 in 1898. The wrought pipe trade has increased rapidly. Though it is not separately stated, it is known that it is the principal part of the item "pipes and fittings," which had a valuation of $6,763,396 last year, a great gain over $4,595,451 in 1898 and $1,252,252 in 1897. The wire trade reached $5,526,930 last year, an increase of more than 80 per cent over the total of $3,036,818 in 1898. Wire nail exports were 37,500 tons last year, against 15,000 tons in 1898, and the valuations were $1,667,976 and $574,909 respectively. The foreign rail trade fell off greatly, as the following comparison will show:

	1897. Tons.	1898. Tons.	1899. Tons.
Europe	4,626	34,470	21,150
British North America	63,924	107,669	92,039
Central America	1,374	1,070	1,102
Mexico	17,309	37,781	20,872
West Indes and Bermuda	1,886	7,338	9,083
South America	2,650	14,833	7,943
Japan	36,353	45,131	5,151
Asia and Oceanica	12 373	27,880	85,353
Africa	2,313	17,420	28,624
	142,808	293,592	171,272

The value of last year's rail exports was greater than that for 1898, however, being $6,122,382 against $5,838,464.

The iron and steel import statistics for 1899 show an increase in valuation, the total being $15,799,206, against $12,474,572 in 1898 and $13,835,950 in 1897. The summer and fall imports of low-phosphorus Bessemer pig from Great Britain helped to swell the pig iron total, which also represents, no doubt, increased imports in ferro-manganese. The total of pig iron imported was 40,372 tons; in 1898 it was 25,152 tons and in 1897, 19,212 tons. The imports of tin plate, which are still the largest item on the list, fell to 65,985 net tons last year, as compared with 74,788 net tons in 1898 and 93,912 net tons in 1897.

Iron ore imports rose to 674,098 tons last year from 187,93 tons in 1898 and 489,970 tons in 1897. The total for 1900 promises to exceed considerably that of 1899.

PERSONAL.

We are glad to note the appointment of Wm. G. Gray, of Philadelphia, as expert special agent for the Twelfth Census, in charge of the collection of iron and steel statistics. Mr. Gray has been Mr. Swank's very competent assistant for a number of years, and with this important branch of the census work in his hands the iron trade is assured of painstaking and accurate service.

Thomas Connely, manager of the Lawrenceville plant of the Shiffler Bridge Works, Pittsburg, has been placed in charge of the new Homestead plant of this concern.

Arthur R. Schultz, agent of the Westinghouse Electric & Mfg. Co. at St. Petersurg, was in Pittsubrg last week.

H. B Clow, of James B. Clow & Sons, Chicago, has returned from a month's outing at Pasedena, Cal. This is the first vacation Mr. Clow has been able to take for over a year and a half, in view of the press of duties in connection with the purchasing for his company.

William J. Chalmers, president of Fraser & Chalmers, Chicago, was elected president of the Commercial Club of that city at the annual meeting of the club last Saturday evening.

PORTIONS of the machine and blacksmith shops formerly occupied by the Westinghouse Electric & Mfg. Co., Duquesne Way and Garrison Alley, Pittsburg, were destroyed by fire early Wednesday morning, Jan. 31. The loss is $6,000. The buildings were recently leased by the R. D. Nuttall Co., of Allegheny, gear manufacturers. The fire will considerably delay the removal of their plant.

AN EXPERIENCE WITH FOUNDRY CHEMISTRY.

To the Editor:

Referring to the last half of the first paragraph of Dr. Kirk's founder-excusing article, "The Chemist and the Foundry," in your issue of the 18th inst., we note the origin and resurrection of rumors whose acceptance without investigation detracts much from his plea for the real value of foundry chemistry. He appears to have accepted as a terrible example of mis-applied chemistry what we and others who know the facts appreciate as the third great step in the foundry department of our wheel business, the first being annealing or very slow cooling of chilled castings for first day in a preheated pit, and the second being the contracting chill ring, which was first applied at our works, and is now well known in various forms.

By our old economies of the chemical method and the high quality assured and by an improvement in annealing first applied here, we have been able to resume business in the face of rumors referred to. We therefore feel that though our name is not mentioned we have the right to shake such dirt from ourselves when an attempt is made to accidentally bury us alive under a general epitaph which may injure others as well; in fact, "quite a number of firms" who have failed at various times and for various reasons, always charged to the last medicine and not to the effects the previous real disorders and overloads. We still employ the same "iron doctor," who is known to have prolonged our previous existence by at least three years, and we are not now doing business under a final epitaph. The principal facts are worth enumerating as throwing more light on Dr. Kirk's article and to show that it was not his fault that he did not know so much had already been done and kept fairly quiet for commercial reasons. And naturally, though of scientific and financial interest, we do not propose to enlarge upon that part of the subject at present.

1. From 1847 to 1872 the firm of A. Whitney & Sons frequently lost nearly entire heats of wheels on account of the metal not meeting their well known high standard as to chill and strength. This was in the days when they and all wheel makers used only cold blast charcoal pig iron, very few old wheels and *no chemistry*.

2. From 1872 to 1881 they used steel in their mixture, with very unsatisfactory results, frequently losing large portions of a heat. *Still no chemist to blame.*

3. By 1885 they had returned entirely to charcoal irons but no mixtures were made on a chemical basis until 1889, when the carefully calculated experiments and a chemical system of control worked out by our Mr. Asa W. Whitney since 1884, aided by his previous furnace laboratory and foundry experience, proved itself decidedly in advance of the anxious "rule of thumb" method by its far more uniform success in the *close prediction of results, while the iron making was still in the hands of the "practical experience."*

4. Being in close touch with the foundry and laboratory, this system in his hands has ever since been the guide in buying and mixing irons and the results as to quality and economy have been entirely saitsfactory; the laboratory expenses being less than the former expensive trial melts and tests which did not always show what the metal in question would do in company with other metal in a mixture. There were considerable losses, it is true, at times, owing to iron contracts not in accordance with iron mixers' views and the stock on hand, and especially at one time (though nothing like those old time losses) through the inefficient management of a superintendent. But this was at once remedied after he left.

5. When the works, which instead of being "out of business" were turning out over 200 wheels daily, were closed by the assignee with $30,000 of orders on the books, all the wheels passed the rigid railroad tests, or in case of light wheels were accepted, and we have heard them praised since and are now filling similar orders. There was no accumulation of wheel scrap, as all cupola return was always promptly used up.

6. In January, 1899, manufacture was resumed and with expressions of gratification on the part of many of our old customers at being able to get our wheels again.

7. During our temporary stoppage our Mr. A. Whitney applied his method at a soft iron foundry where the firm and their chemist had become equally discouraged. That chemist became as pleased as his employers and we understand his position is now secure.

8. Some other car wheel works use some chemistry with more or less success, and one concern older than ours is, we understand, at last preparing to go into the matter thoroughly. We have never heard of a case of business failure in the foundry line caused by "infatuation" with chemistry, but can imagine that some conditions which would ruin a business would make the application of any chemical system impossible.

9. In a large foundry it is entirely impracticable to expect the analyst to combine his sufficient duties with that of a careful calculator of mixtures and their almost daily adjustments, of close advisor to the iron buyer and of a foundry expert. All but the analyst's business should be the duty of the foundryman (and assistants, if necessary,) and with a proper system it is merely a matter of convenience and safety to have the analyst at the foundry as well as at the blast furnace, as blast furnace sampling is usually sufficient to sell and buy on but not often to figure very closely upon.

Whitney Car Wheel Works,
Successors to A. Whitney & Sons.

Philadelphia, Pa., Jan. 24.

Hulett Ore Handling Machinery.

The Webster, Camp & Lane Machine Co., of Akron, O., is now building for the Pittsburg & Conneaut Dock Co. (Carnegie) two additional ore unloaders, in all particulars duplicating the machine put on the ore docks at Conneaut last year and illustrated in our issue of Nov. 9. The new machines are to be ready for use by May 15. The hatches of the new Carnegie vessels will be built wide so as to accommodate the Hulett machines, and the hatches of other vessels in the fleet will be widened. It will be possible to operate the three machines at once in unloading a single vessel, and with the use of a revolving derrick to clean up the last of the ore under each hold, very rapid work can be done. Each machine can unload from 250 to 300 tons an hour. It is estimated that fully 3,000,000 tons of ore will be handled at the Conneaut docks the coming season and unusual dispatch to vessels is aimed at.

The Webster, Camp & Lane Machine Co. has also taken important contracts recently for the Hulett equipment for handling ore at blast furnaces. The National Steel Co. has ordered for its new Mingo Junction, O., blast furnaces a duplicate of the car dumper, ore bridges and other equipment for unloading, stocking and putting ore in bins, installed at its Youngstown furnaces, as already described in these columns. A similar order has been given by the American Steel & Wire Co. for its new Neville Island plant. The equipment for the latter will deviate a little from that at Youngstown, a change being made in the towers on account of the slightly different heights of the walls enclosing the ore stock yard.

John A. Penton, proprietor of the *Foundry*, of Detroit, whose acquaintance with the foundrymen of the country is almost co-extensive with that industry, announces that he will start a new publication in February, a monthly, to be known as *Penton's List*. It will be distinctively a medium for buyers and sellers of second hand machinery in all lines of manufacture. Subscribers to *Penton's List* have the privilege of advertising free in its columns second hand machinery they desire to sell or that they want to buy. The field appears to be the only one not filled by a special journal and the idea of the originator promises to work out into a success quite rivaling that of the *Foundry*.

The production of spiegeleisen and ferro-manganese in the United States in 1899 was 219,768 tons, against 213,769 tons in 1898.

By the upsetting of a ladle car containing cinder, the electrical building at the Bellaire, O., plant of the National Steel Co. was set on fire and destroyed Jan. 30, with all its equipment. The loss of the electrical machinery will be a serious interruption, as several weeks will be required to replace it. The loss is reported at $100,000.

River Furnace, Cleveland, made a record output one day last week—266 tons in 24 hours. The furnace is 65x16½ feet.

THE IRON AND STEEL STOCK MARKET.

Denison, Prior & Co., say in their weekly letter on the iron and steel stocks: "The action of the directors of the American Steel & Wire Co. had a stimulating effect, not only on the issues of their own company, but on those of the other steel companies as well. Steel and Wire common had a wide opening Tuesday, the official report being 7,500 shares at 51½ @ 52¼, the latter price being an advance of 2¼ points over Monday's closing figure. During the day the price advanced, on inside manipulative buying to 55⅛, the close being at 54⅞. American Hoop, National Steel and Federal Steel common issues were all strong features and were well bought on the supposition that the near future held dividend prospects in store for their owners.

"The market shows a disposition to proceed regardless of the course of events in South Africa. The worst has happened in that quarter and has been fully discounted. A great many conservative houses have become more bullish on the situation and feel that the market should advance unless conditions in this country show a decided change. At present everything favors the bulls. Money is plentiful and prosperity continues. London now follows New York instead of leading it and under these conditions we cannot help but feel that good stocks are a purchase on all recessions."

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and stee stocks in the week ending Jan. 29, also the high and low points for the year:

Name.	WEEK.				YEAR.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy.....	13	13	12¾	12¾	14⅜	Jan. 4	12½	Jan. 15
Am. Car & Fdy pr.	60½	60½	59	59	62½	Jan. 4	59	Jan. 29
Am. Steel & Wire..	48⅛	50¾	46⅛	50¼	50¾	Jan. 2	45¼	Jan. 15
AmSteel & Wire pr	90¾	91	90	90⅞	92⅜	Jan. 3	89	Jan. 15
Am. Steel Hoop.....	42	42¼	42	42	45	Jan. 3	41½	Jan. 17
Am. Steel Hoop pr	81	81⅜	80	81	83	Jan. 2	80	Jan. 23
Am. Tin Plate.....	29¾	29¾	27⅞	27⅞	34½	Jan. 3	27⅞	Jan. 29
Am. Tin Plate pr..	81½	81½	81½	81½	83	Jan. 2	80⅜	Jan. 12
Col. Fuel & Iron...	43	43¼	41⅞	42	46½	Jan. 3	40½	Jan. 8
Federal Steel.....	51⅜	52	50⅞	51	55¾	Jan. 2	47¾	Jan. 11
Federal Steel pr....	74	74	73	73¼	76	Jan. 2	70¾	Jan. 10
National Steel.....	42¼	42½	40	40⅜	46½	Jan. 3	40	Jan. 26
National Steel pr..	92½	93¼	92	93¼	93¼	Jan. 29	92	Jan. 9
Pressed Steel Car..	56½	56¾	55⅝	56	58¾	Jan. 17	55⅝	Jan. 26
PressedSteelCar pr	87¾	88	87	87	88¼	Jan. 17	85½	Jan. 9
Republic Steel	21	21¾	20⅛	21⅜	23¾	Jan. 3	19⅜	Jan. 15
Republic Steel pr..	65¾	68	65¾	66	68½	Jan. 5	64½	Jan. 18
Tenn. Coal & Iron	85	86	82	83⅛	87¾	Jan. 3	79¾	Jan 11

Notes.

The directors of the American Steel & Wire Co. met Jan. 29 and declared a dividend of 7 per cent on the common stock, payable in four quarterly payments, April 2, July 2, Oct. 2, 1900, and Jan. 2, 1901. The statement issued showed that the company had made a net profit of $12,162,530 in 1899. The stockholders will meet in Chicago Feb. 10, when action will be taken on the proposition to retire $5,000,000 of the $40,000,000 preferred issue of the company. Chairman J W. Gates, in commenting on the action of the board of directors said: "From the outlook of the business it is safe to say that the earnings for the year 1900 will be still better than those of the past year, assuring to the stockholders of the company, both preferred and common, every expectation of permanent dividends."

It is reported that the net earnings of the National Steel Co. for November and December were $2,300,000.

The statement of Tennessee Coal & Iron Co. for December showed a surplus of $255,577; being an increase of $228,531 over the same month in 1898, and an increase of $16,530, as compared with the preceding month. This is the largest surplus for any one month shown during the year 1899. The increase is noteworthy, in view of the fact that December operations are restricted by the holiday season when laborers take a rest for several days.

At the annual meeting of the Empire Steel & Iron Co., in Jersey City, the stockholders authorized the directors, in their discretion, to take steps to double the capital stock, making it $10,000,000. The company was organized in March.

It is reported that the Pressed Steel Car Co. has orders ahead amounting to $20,000,000 and running to Aug. 1.

The announcement is made that the Pennsylvania Steel Co. did $20,000,000 gross business in 1899, surpassing any year in its history since 1892. Net earnings are understood to have been between $1,250,000 and $1,500,000 over preferred dividend. The December earnings are given as $240 000 over interest charges and November is said to have been larger.

THE SELLING SIDE OF THE TRADE.

Representatives of Well Known Iron and Steel and Equipment Firms.

Miss Y. R. Baumgarten, of Pittsburg, enjoys a peculiar distinction. She is probably the only woman in the country who has charge of a business in iron and steel. In the latter part of last year, after having been for some time the Pittsburg representative of a Cincinnati firm dealing in old material, she opened an office at 1221 Park Bldg., for Jos. Schonthal, of Columbus, O., dealer in scrap and in relaying rails. Miss Baumgarten's acquaintance with the scrap iron trade began in Cincinnati at the home office of the company she first represented in Pittsburg, serving in the capacities of stenographer, clerk, bookkeeper and telegraph operator. Rapidly she acquired a familiarity with all details of the business that justified her promotion to the management of the Pittsburg office when a vacancy occurred there. It will be appreciated both by buyers and sellers of old material that this department of the iron trade is by no means the

MISS Y. R. BAUMGARTEN.

easiest for a novice, and particularly a woman, to essay. But it is conceded that Miss Baumgarten, taking the conditions just as she found them and by dint of tact, pertinacity and hard work, has won an enviable success. She inclines the view that there is little in the scrap iron business to attract the average person of either sex. Without setting out to be a saleswoman in iron and steel, she has simply made it a point to succeed in all that she has undertaken, and the responsibilities have come by the way. In the selling side of the business Miss Baumgarten has shown special talent.

The Pennsylvania Steel Co. has announced an increase of 10 per cent in the wages of nearly 7,000 employes, taking effect March 1. At Altoona, Pa., the Altoona Iron Co. has advanced puddlers' wages to $4.25, a 25-cent increase instead of the 50 cents asked.

The rod mills of the American Steel & Wire Co., Beaver Falls, Pa., were operated double turn Tuesday night for the first time since the strike of the rod mill workers. Enough men have returned to work to make it possible now to operate the mills double turn. The Cleveland strikers are evidently desirous of returning to work, but the leaders at a meeting this week succeeded in postponing formal action.

THE FOUNDRY CHEMIST'S RESPONSIBILITY.

TO THE EDITOR:

I was somewhat surprised to find my article on foundry chemistry criticised as it was in the issue of *The Iron Trade Review* of Jan. 25, by so able a foundryman as Mr. Thos. D. West. He says: "The one great mistake of some founders who endeavor to be guided by analysis in making mixtures is that they think the chemist should be held responsible for the final results for the quality of the iron in the casting."

Does Mr. West hold his molders responsible for their castings, or does he allow them to turn out bad castings, day after day, and receive pay for them? Does he continue in his employ a pattern maker, who makes a pattern that cannot be drawn from the sand; or a core-maker, who makes a core that causes a casting to blow, day after day? I think not.

Do not manufacturers in every line hold their workmen responsible for their work, and are not poor workmen discharged and replaced by good ones, whenever such can be obtained? Then why should not the foundry chemist be held responsible for his work, and what use have the foundrymen for him if he is not responsible for final results? I think Mr. West will find that the laboratory of the blast furnace is held responsible to a large extent for the grade of iron coming from the furance. But a blast furnace is not a cupola, and its working should not be compared with that of a cupola. The one hundred and one things that can change the grade of iron after it is charged into a cupola are the one hundred and one things the foundryman desires to overcome. And who should be able to do it more thoroughly than the chemist? He has it in his power to analyze everything that is put into an cupola, even to the lining and daubing, and to locate trouble with any one of them and suggest a remedy. If it is not in the material and he is not sufficiently familiar with the management of a cupola to suggest a remedy, then he cannot prove he is correct, and the trouble only becomes one more factor upon which a poor melter can found excuses for bad melting.

"A good chemist gives up several years of his early life to learning to make analysis, and when he has done this it is all that should be expected of him," etc. Of what use are his analyses if he has not sufficient knowledge to apply them and obtain from them the results desired by the foundryman? Such analyses are furnished by the blast furnacemen, of their own irons, free of charge; and if the foundryman has to figure out mixtures from analysis he may as well take the analyses of the furnacemen as those of his own chemist.

If the young man who is spending several years of his young life in learning to be a chemist can go no farther than make analysis, he had better devote his time to some other calling; for I do not think he will find employment in a single foundry in this country. "Let the shoemaker stick to his last." The saying applies very forcibly to the founder, who should not attempt to be a chemist or make mixtures from chemical analysis without proper training, and also applies to the chemist who should remember that the shoe is not finished when the sole has been tacked upon the last.

I did not make the statement that the chemist should be held responsible for bad castings. On the other hand, I stated that he should be able to defend his iron and to place the blame for hard and dirty castings where it belongs. In conclusion, allow me to say that chemistry has been introduced into many foundries upon the theory advanced by Mr. West that "the chemist should only be required to make analyses and should not be held responsible for results." In my opinion, this theory is all wrong, and if it is persisted in chemistry will never become a success in foundry practice. The chemist should be trained to apply his analysis to practical work and to be held responsible for results. A course in applied foundry chemistry should be established by the mechanical training schools that will fit the student for the work he should be able to do before seeking employment as a foundry chemist.

As for Mr. Spera's criticism and inquiry as to the cause of hard iron in castings when soft iron has been drawn from the cupola, I will refer him to Mr. West, who can pour hard and soft iron from the same ladle. EDWARD KIRK.

Philadelphia, Jan 26.

The Bethlehem Steel Co. is shipping to Paris a large exhibit of its products in armor plate and shafting.

CAR WHEELS FROM THE MAKER'S STANDPOINT.

TO THE EDITOR:

An article appears in your paper of Jan. 4th, entitled "Flange Wear and Chill in Car Wheels." No one will dispute that cold blast charcoal iron is the best for car wheels, also for any other thing where cast iron is used. But the writer denies the proposition that the use or non-use of it has anything to do with cut flanges in car wheels.

If it is true that it would prevent the chill being light or almost reduced to nothing in the throat of the wheel, as shown by black stroke on the cut given in the article you reprinted then certainly its use would not only be desirable, but indispensible at any cost. The correspondent quotes a number of chemical amalgams from which the wheel makers are enabled to make wheels, but the article suggests very forcibly that the wheels are imperfect, and that the mixture is the cause of cut flanges—a very prevalent trouble (not more so possibly than when cold blast iron was largely used); but circumstances often reveal facts that might not be noticed under different conditions.

Permit the writer to refer to some of these, and to say that it is only within the last half dozen years or so that they were taken much notice of, as railroads did not think of asking a replacement for cut flanges, nor, indeed, do they yet very much; but outside parties who had their own cars began some few years ago to demand guarantees from wheel makers, some of whom in the dull times, and over-anxious to get business, submitted and gave the required guarantee. But the writer is well aware that each and all have cause to regret such action. Let us look into the facts and compare the quality of wheels past and present, quality of irons included.

In the first place, I absolutely deny that the iron used today for chilling purposes has anything to do with uneven chill shown in the throat of the wheel sketch, and maintain that any iron that will sufficiently chill will not show such a discrepancy if properly handled; and when such defect occurs, it is not in the iron we should look for it, but in the handling. It is a mechanical defect pure and simple. No doubt the throat of a wheel is subject to being slightly lighter in chill than the tread or flange, unless the flange is cast in sand (cause well known), but not so much as shown in sketch.

Secondly, it seems to me that the article has an object in view; i. e., to make it appear that all such defects in wheels (i. e., if a cut flange can be called such) are the fault of the wheel maker. To this I take exception, and beg to state that in not one in one hundred wheels condemned for cut flages, is the condition chargeable to the wheel maker. Nothing but a low chill, or almost no chill at all, could make it possible, and under present practice, and with the care that is taken, it is almost absolutely impossible to occur. All wheels that the writer knows of are carefully measured with a tape made for the purpose, and paired and marked, which makes it not only easy for the fitters pairing on axles, but also enables the maker to determine a high or low chill, neither of which is judicious to ship. And for self-protection it is not done, as the one would wear out and have to be replaced while the other would be apt to break and create trouble.

This taping saves railroads and others the trouble of pairing, that being done by wheel makers, and much more accurately than used to be customary. Bad pairing is the cause of many cut flanges. Trucks being out of square is another, as when not running straight on the rails but pulling at an angle naturally one wheel hugs the rail while its mate is running away from flange out on the tread, treating both wheels badly and to their hurt. Since the change in car couplings began wheels have also suffered much, because the old and new do not couple fairly, causing cars to pull against each other at angles, thus forcing wheel flanges against the rails, cutting them badly, also requiring extra motive power.

Compare the wheel test and car service of 20 years ago with the present: Then there was no test for strength excepting probably a few blows of a sledge. Now there is a 140-pound drop test 12 feet onto the wheel, resting on three blocks of iron placed on solid masonry, the wheel being required to stand 8, 10 or more drops without breaking. No wheel made 20 years ago would stand it. In some cases expansion tests are required. Whoever heard of that 20, or 10 years ago?

Let us examine the guarantees of the dates mentioned with

the service of cars: Twenty years ago the freight car load was 10 to 12 tons; rate of travel 15 to 25 miles an hour; guarantee three years. Today the freight carload is 25 to 60 tons; travel, 25 to 40 miles per hour; guarantee five years. Comparison is odious. Twenty years ago (yes, 10 years ago), 50,000 mile guarantee for passenger wheels; today, 70,000 miles. Again comparison is odious.

When such stubborn facts are presented that cannot be gainsaid nor contradicted, wheels reduced to less than one-half the price, do wheel makers deserve no credit for such an advancement in the face of the change of materials? It would seem that many buyers do not understand, or are unwilling to, but are ready to blame them for doing so much.

A WHEEL MAKER FOR OVER 26 YEARS.

New Japanese Steel Plant.

Prof. B. Mano, instructor in mechanical engineering in the Imperial University, Tokio, Japan, and Ritaro Hirota, a member of the firm of Takata & Co., iron and steel merchants in the same place, spent several days in Pittsburg last week. They visited a number of the large steel plants in and about the city and left later for New York. Hirota pays this country a visit on business for his firm, while Mano has a leave of absence, and will visit the Paris Exposition before his return to Japan.

In speaking of the steel industry in Japan, Hirota said that the government plant, which is being erected at Yamatamura, province of Chikuzen, in the southern part of Japan and in the heart of the coal district, is nearing completion. It will be the first attempt at steel making in Japan. The capacity of the plant is to be about 250 tons daily. When the Japanese government decided to go into steel manufacture on its own account several years ago, engineers of the Oriental schools were sent to this country, England and Germany for the purpose of studying methods of steel making. Some time was spent in this country and then they journeyed to England. Germany being the last country visited and last impressions being strongest, the German method of steel manufacture was recommended to the government. Outside of the furnaces and the heavy machinery a large amount of equipment patented and manufactured in this country will be purchased.

The ore for the furnaces connected with the new steel plant will be brought a distance of 500 miles by water. As is the case in this country the Japanese are bringing the ore to the fuel instead of the fuel to the ore. Hirota stated that 15 years ago furnaces were built in the ore district of Japan. White iron was the chief output, which mixed with imported pig was used for foundry purposes. These furnaces will not be abandoned despite the fact that they are not at all up to date. Much of the ore that will be used at the steel plant will be brought from China. The finished product of the steel works will consist of sheets, bars and structural material.

THE core-makers in all Cleveland foundries went out on strike Monday, Jan. 22, for a uniform advance from $2 25 to $2.50 a day and a signed agreement to continue the $2 50 rate for one year. The Lorain Foundry Co.'s men also made the same demand. In some cases $2.50 was already being paid and the only question was as to a year's agreement. The matter was taken up by the Cleveland Foudrymen's Association at a meeting on Saturday, Jan. 27, and the following communication was sent to the core-makers: "The Cleveland Foundrymen's Association is governed by the rules and bylaws of the National Founders' Association. A committee will gladly meet representatives from the core-makers, with the object of arriving at a fair and equitable settlement of the wage question, after the core-makers now out return to work. We have no doubt that a fair and speedy adjustment of our differences can be reached if the men comply with the above specifications." To this the men replied that it was impossible for them to comply with the request to return to work and that if the foundrymen wanted a conference they would find the men's committee at their headquarters. Upward of 100 men are out and operations on cored work are generally suspended.

AN error was made in the statement of the dimensions of the Lennox Machine Co.'s rotary splitting shear, described in our last issue. The knives are 10 inches diameter and the machines are made with 4-ft., 6-ft. and 8-ft. throat.

IMPROVED HOT BLAST AND CHIMNEY VALVES.

Late designs of hot blast and chimney valves for blast furnace stoves, as perfected by Julian Kennedy, of Pittsburg, are shown in the two accompanying illustrations. In Fig. 1 the hot blast valve is shown in section and employs the familiar Berg removable seat F. This seat is clamped between the two conical shaped steel castings E, which are brought together by clamps Z. These clamps are made with bronze nuts, having right and left hand threads, and may be removed entirely, giving access for changing the seat. The principal feature of this hot blast valve, however, is that the

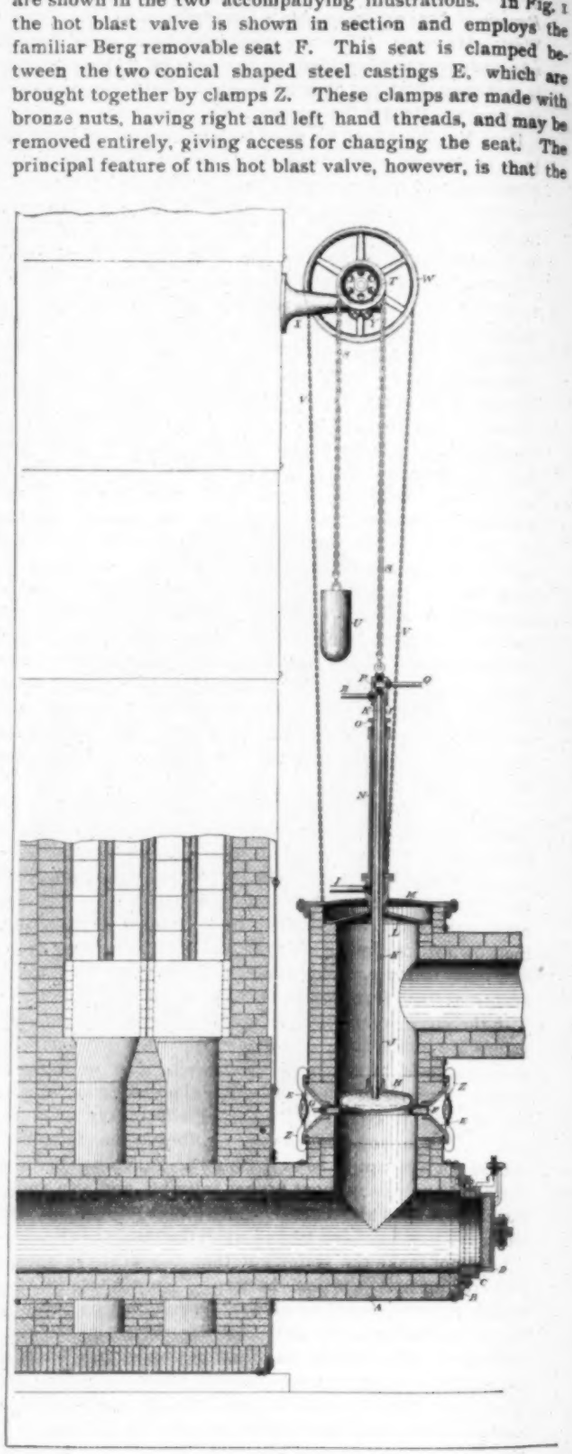


FIG. 1.—IMPROVED HOT BLAST VALVE.

stem may be kept perfectly tight, no leakage being evident after some years of use. The ordinary stuffing box is replaced by an extension N, with a gland and soft packing O; the stem itself is hollow, and supplied with the usual inlet and outlet for water cooling. The pipe I is connected with the cold blast main in which the pressure is always found to be about an ounce above that of the outgoing heated blast delivered by the stove. In consequence there is always a thin film of cold air passing down between the bored hole in the cover M, and the sides of the stem J, so that the light flocculent matter coming through the stove, and which is the prin-

cipal source of injury to the valve stem, is prevented from passing up or around any portion of the stem which works through the gland and packing at O. The stem is thus packed under favorable conditions, and is always cool and clean where it passes through the gland.

Fig. 2 shows the chimney valve in section. The seat B has a water cooling pipe cast in, in the ordinary way; the discharge from this seat is carried up by the pipe D to the center of the cover G, where it discharges into a circular cooling space. This water overflows into a second and thence into a third cooling space, and wastes through the pipe W. The valve C is cast of steel and suspended by a solid stem E. This stem is supplied with adjustable nuts and a soft washer at F, so that when the valve C is on its seat and the stove is on air, the soft washer will be sufficiently compressed to prevent any leak. When the stove is on gas and the valve is raised to its upper position it is kept cool by its close contact with the water cooled cover G. The valve and stem are both light, and when half way up are balanced by the weight P, so that if the valve is raised past the center the excess weight of the chain acting with the weight P raises and holds the valve against the cover. When the valve and stem are dropped below the center of their travel, the excess weight of the chain with the valve and stem allow the valve to drop and to remain on the seat.

These stove fittings have been adopted by the Carnegie Steel Co., Ltd., the National Steel Co., the Illinois Steel Co. and the Cambria Steel Co., and are being applied gradually to other existing and new plants.

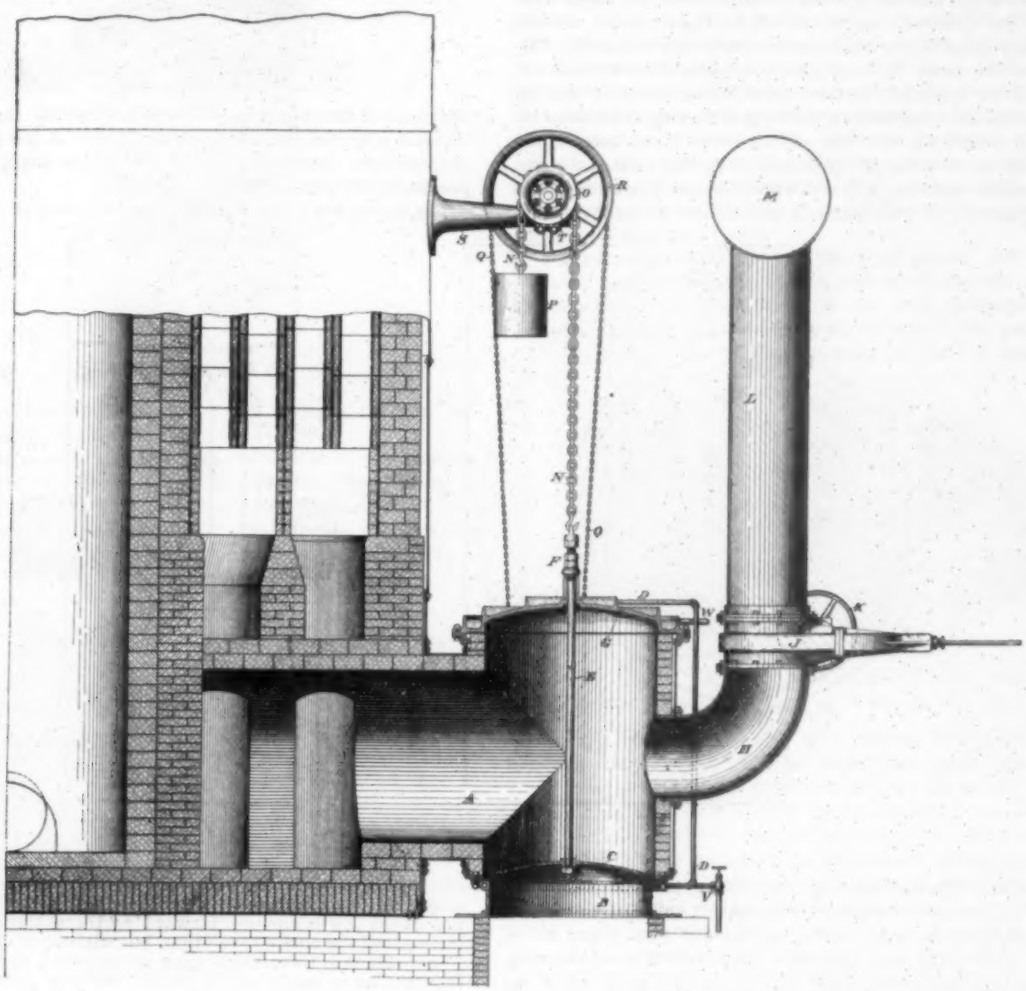


FIG 2.—IMPROVED CHIMNEY VALVE.

FIGURES just compiled show that during last year 1,571,570 tons of pig iron were shipped from Alabama and Tennessee. Of this Alabama forwarded 1,257,256 tons, a gain over the year previous of 200,000 tons. Shipments of iron pipe were 146,637 tons, a gain of 10,237 tons. Export pig iron shipments were 167,003 tons, a decrease of 34,675 tons.

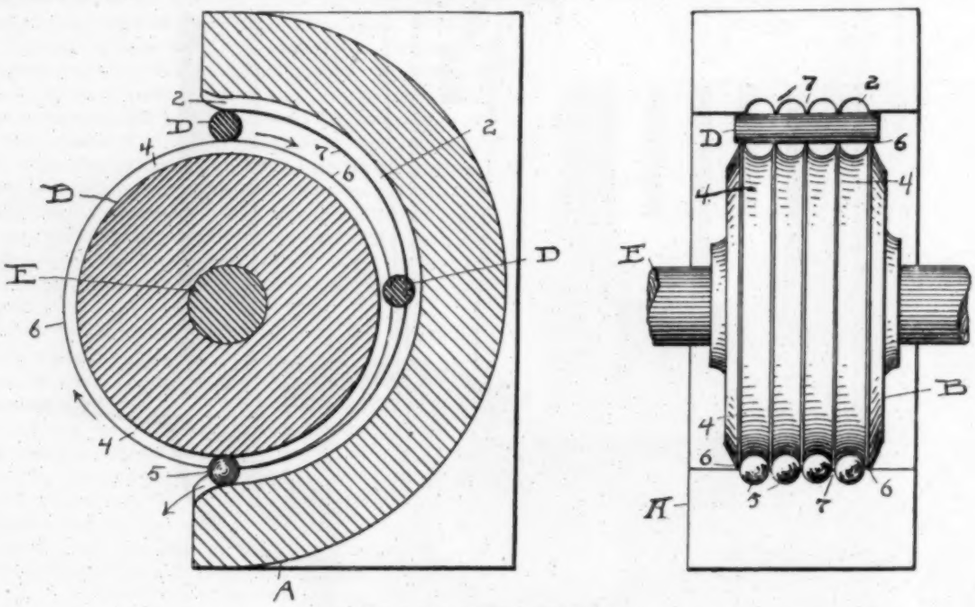
AT a meeting of a portion of the stockholders of the Susquehanna Iron & Steel Co., held at Philadelphia, resolutions were adopted opposing the acceptance of the offer of the recently chartered Atlantic Iron & Steel Co., to take over the company's plant and favoring the erection of a pipe mill at Columbia in view of the fact that skelp iron could not be marketed profitably.

AT Canal Dover, O., there is some agitation by business men of the erection of an open hearth steel plant, with a view to supplying the sheet mills in that vicinity. The black plate mill of the Reeves Iron Co., which was taken by the American Tin Plate Co. may be closed permanently in the concentration of the latter company's plants. There is a probability, also, of the Reeves Iron Co., which produces merchant bars and sheets, and of the New Philadelphia Iron & Steel Co. going into the sheet mill consolidation. The scheme as it has been broached is to form a company which shall take over the Dover Furnace at Canal Dover, erect a basic open-hearth plant and acquire also the sheet mills in the district. New Philadelphia is but five miles away. Cambridge, the seat of the Cambridge Iron & Steel Co., is in the adjoining county to the south, and Coshocton, the location of the new Coshocton Rolling Mill Co., is in the next county to the west. The proposition involves a large amount of money, more than is likely to be raised in a popular movement.

The Sharon Steel Co., Sharon, Pa., has given a contract to the Morgan Construction Co., of Worcester, Mass., for the erection of two rod mills, a billet mill, shears, heating furnaces, reels, tables and other wire mill machinery. The capacity of the plant will be 400 tons a day.

MACHINE FOR MAKING STEEL BALLS.

Wm. W. Brisben, of Cleveland, has devised a machine for the manufacture of steel balls, particularly anti-friction balls for bicycle bearings and like use. The vertical section elevation of the machine, as in Fig. 1, and the side view given in Fig. 2 indicate the construction and operation of the machine. The stationary base A has a semi-circular concavity provided with a series of parallel grooves 2 on its inside. The roller B has a series of concentric grooves 4 corresponding in arrangement and construction to the grooves 2. Both sets of grooves are semi-circular in cross-section, and thus when they are brought together at their edges, as at the bottom in Fig. 1, they together form a perfect circle in cross-section. Any object that is rolled in the grooves and given shape thereby must take on a spherical shape and issue from the machine in that form, as several balls 5, Fig. 1, illustrate. The grooved roller B is fashioned on the smaller circle so that when it is placed with the edges 6 of its grooves in contact with the edges 7 between the grooves 2, as at the left in Figs. 1 and 2, there is sufficient space left at the opposite side of the concavity to introduce the stock D, from which the balls are produced. If the rod be intended to form anti-friction balls, it will be of suitable steel heated to a working or flowing condition. It is then placed in the bite of the roller B and base A, and since the roller is supported on a shaft E and rotated the material will at once begin to roll while it works down lower and lower between the two parts A and B, and is thereby gradually severed into ball-forming sections by the comparatively sharp edges 6 and 7 between the grooves 2 and 4, the sections, corresponding to the grooves in size and form being at the same time rolled into spheres. Both operations of severing the sections and rolling them into spheres are going on at the same time, until at last the severing is completed and the stock is converted into the solid spheres shown at 5, and in this form they leave the machine.



MACHINE FOR MAKING STEEL BALLS.

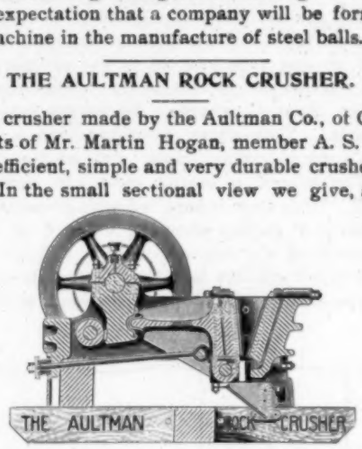
The stationary base A is semi-circular, as shown, but it might be merely a segment of a circle or it might extend farther around and form a complete circle and still serve practically the same purpose. The introductory side of the base need not be drawn to a true circle, but both the base and the roller B must be formed on true circular lines from the point where they begin to operate—as, for example, the point where the stock D first appears in the drawings to the finishing-point, where the balls 5 are discharged. In this operation the fibre of the steel is not disturbed and the balls are uniformly pressed from all sides, so as to give them uniform density. They are discharged from the machine in a rough state corresponding to their condition when taken from a lathe in the process first above described, and they are then ready for grinding and hardening as before and by the same means.

The drawings show a machine with four grooves, but more can be used and thus materially increase the output of the machine. As it is, the machine is said to be able of producing balls at a rate which greatly cheapens production and produces a perfectly spherical ball, which readily receives the further treatment of grinding and hardening.

It is the expectation that a company will be formed to employ the machine in the manufacture of steel balls.

THE AULTMAN ROCK CRUSHER.

The rock crusher made by the Aultman Co., of Canton, O., after patents of Mr. Martin Hogan, member A. S. M. E., has proved an efficient, simple and very durable crusher of great capacity. In the small sectional view we give, an idea is



conveyed of the ingenious construction within the housing, which is a special feature of the machine. A few stong, well proportioned members, actuated by a cam shaft, produce a peculiarly efficient crushing movement.

The movement of the crushing jaw is peculiar. It is not only thrust forward and backward by the action of the cam shaft, but being supported by the swinging arm, some portion of the jaw is moving forward and crushing, practically throughout the entire revolution, but without a dead center. The machine is therefore always doing work instead of half the time, as in machines in which the jaw swings from a pivotal point.

The crushing movement being continuous, the material works down and out without stopping. The crushing movement is always at right angles with the stationary jaw, thereby feeding the material downward. These elements of the machine largely account for its large capacity and good quality of product. The crusher is also economical in the use of power, as shown by repeated tests. Each crusher is tested at the works and the average of all tests reliably establishes that the power required is less than one h. p. for one ton of capacity per hour, on material of average weight and hardness, reduced to pass a 2½-inch ring. The size of the product is regulated by take-up plates between the stationary jaw and housing. A change can be made in a few moments.

The wearing surfaces of pitman and toggle are bushed with renewable chrome steel plates. The jaws when worn at the lower end can readily be inverted. The oiling arrangements are such as to facilitate lubrication while the crusher is in motion, without danger to the operator.

Some 300 of these crushers have been sold and are in satisfactory use. The company is now prepared to meet the full requirements of both domestic and export trade. A descriptive catalogue will be mailed to engineers or prospective purchasers.

THE WEISS MOLDING MACHINE.

In the development and introduction of the Weiss molding machine, the Maywood Foundry & Machine Co., of Maywood, Ill., has sought simplicity of construction and of operation—a machine that would facilitate the work of making molds without increasing the cost of other labor in the foundry. The manufacturers start out with the proposition that there is not now and probably will not be made a molding machine that will permit of dispensing entirely with skilled labor; but there are patterns in nearly every foundry that can be placed to advantage on machines. On these, it is claimed, a successful molding machine will not only effect a great

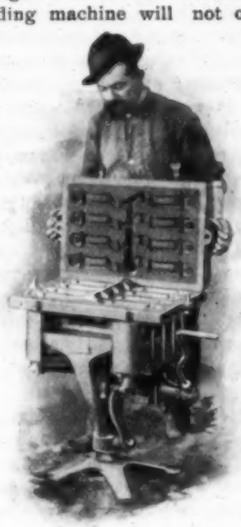


FIG. 1.—WEISS MOLDING MACHINE.

saving in the cost of molding but will insure a uniform output of castings, both as to shape and weight.

The illustration Fig. 1 gives a general idea of the machine. It shows the operator holding the completed mold ready to set on the floor. This type of the machine is built in all sizes to take snap or solid flasks up to 18x24 inches. Round machines are made which take work from 10 inches up to 20 inches in diameter. The machine in Fig. 1 takes a flask

FIG 2.—MACHINE WITH PATTERNS AND PLATES REMOVED.

14x22 inches. The company also builds large machines up to any required dimensions, and operated by hand or compressed air. The construction is such that the machines can be adapted to a great variety of patterns. Changes from one set of patterns to another are made by removing the screws from the tops of the four guide posts which support the stripper plate, and the four screws in the corner of the pattern plate, when the plate and pattern may be lifted off and another put on. It is stated that a laborer can make the change in two or three minutes. As indicating the capacity of the machine, a pin for the Chicago draw bar, manufactured by the Latrobe Steel & Coupler Co., of Philadelphia, at its Melrose Park, Ill., plant, is instanced. It was formerly made by hand and a molder made 96 in a day. It is now made on the machine shown in Fig. 1. There are eight pins on a plate, and two laborers with a set of the machines make 320 in an hour. The saving in the grinding of castings is said to amount to about $5 on a day's product over the old way of making the pin.

Fig 2 shows a few patterns and plates used on the type of machine in Fig. 1. The machine is shown with stripper plate and pattern plate, with attached set of patterns removed, illustrating the method of fastening patterns. The latter are never taken off their plate, being firmly fastened to it with countersunk screws and dowel pins. Four screw holes are shown in the pattern plate by which it is fastened to the movable yoke, and countersunk holes are shown in the stripper plate through which screws are inserted and fastened in the ends of the guide and supporting posts. The plate on the left hand shows the stripper plate and pattern plate with gate ready to be mounted on machine.

The cope is usually rammed up on one machine by one man, and the drag on the other machine by another man—two men thus working together—the two machines matching the mold and making a "set." The usual practice is to start these machines at one end of the sand pile, and as the sand and flasks are used up to move the machines along with the work. After shaking out, the flasks are stacked on either side, and the sand shoveled up and left in the same position on the floor as before. There is no wheeling of sand or carrying of flasks, bottom boards, etc., up to the machine which stands in one spot, and no time consumed in carrying molds to a distant point on the floor. It is not the actual ramming of a flask that consumes the time in making a mold, it is pointed out. The ramming in itself is only a small part of the work. The machine effects a saving during the whole process of making a mold.

Foundry sand finds its way into small places. To provide against wear from this source, the machines are so constructed that the working parts are well protected. The movable portion of the machine which carries the pattern is held in place by four rigid guide posts at the top and a fifth

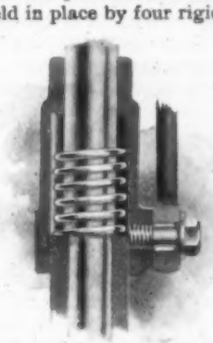


FIG. 3.—THE CUSHION SPRING.

FIG. 4.—ADJUSTABLE BRACKET AND ROLLER BEARING.

central guide at the bottom. The pattern is thus firmly held in position and cannot work loose and wear against the stripping plate. These guide posts serve the double purpose of guiding the pattern plate and supporting the stripping plate. This compact construction leaves the entire machine open and easy of access for the purpose of setting stools. A compression spring relieves the machine of all shock or jar in dropping the pattern, which sometimes causes molds to fall out on other machines. There is no downward motion to the pattern after it has been raised into position through the stripping plate. The adjustment of the pattern through the stripping plate is effected by simply turning a single adjusting screw; and this adjustment may vary from the smallest fraction of an inch up to any required depth of draw.

The manufacturers have this to say as to compressed air and the flasks used on the machine: There are very few foundries today that do not find a profitable use of compressed air in some department of their work. Air hoists supported by light cranes very materially increase the output of molding machines on heavy work; in fact we would advocate the use of the air hoist wherever machines are installed for making molds the halves of which are too heavy for one man to handle Some foundries also use the air hoist to advantage for shaking out large flasks and stacking them.

"We are frequently asked if we can design our machines to enable the use of flasks already on hand. If the flasks are in good condition there is no reason why they may not be used on the machines, provided the parts of the flasks are interchangeable. As a general thing not enough attention is given to flasks whether for machine or hand molding, and while the hand molder may get along after a fashion with poor flasks, they will not do for a molding machine. Good iron flasks with good fittings always pay in the long run, although they may cost a trifle more at the start."

PROGRESS OF THE MECHANICAL ARTS.

BY COLEMAN SELLERS.

(Concluded.)

When the late Mr. Hudson had charge of the Rogers' Locomotive Works he applied to the firm of William Sellers & Co. to have a special locomotive cylinder boring machine designed and built, saying that he had seen a boring machine designed by Mr. Grant, of the Grant Locomotive Works, capable of boring a 19-inch cylinder in nine hours. The matter was referred to me, and when I came to calculate the theoretical time required for boring a cylinder of the size named, on the supposition that the speed of 16 feet per minute might be used in making the cuts, with a fine feed and a deep cut for the roughing cut, and a shallow cut and a much wider feed for the finishing cut, I found that the estimated time amounted in all to only three hours, and named three and a half hours as not only possible, but what might be guaranteed as the productive output of such a machine. An order was given for this machine, it being understood that it was not only to bore the cylinders, but to counterbore the ends for the clearance of the piston, to cut off the sinking head and face of the flanges at each end of the cylinder. When completed, the first test was made with a 19-inch cylinder of hard close metal. This was bored in three hours and twenty minutes exclusive of the time of setting the cylinder, which was not much on account of the peculiar arrangement of the machine, and the facility with which the cylinder could be put in place for boring In this case the cylinder stood still, while the boring bar traveled lengthwise, carrying the cutter head with it, and upon the two face plates of the driving heads of the machine were arranged automatic slide rests that faced off the the flanges. In this design there was no guess work, as the principle of fine feed and deep cut on roughing, with very coarse feed and shallow cut for finishing, was in common use in all operations of boring, turning and planing metals, with exact knowledge as to what result was obtainable when the possible speed of cut per minute had been predetermined for the hardness of the metal to be tooled.

American and Foreign Skilled Workmen.

Since the time when I first related the incident of the rod planer in a paper published by me in the *Engineering Magazine*, in 1892, even this tool, useful as it is, has been superseded almost wholly in locomotive works by improved milling machines. It is not my province to detail step by step the advance that has been made in machine tool building, but, as stated at the outset, I wish to make this industry illustrate the advance in the mechanic arts, and in connection with it I must call attention to the relative condition of the skilled workmen in America and in other countries. We owe much of our progress to our common school system, to our freedom from precedent and to our just patent laws. I do not wish in the slightest degree to decry what has been done abroad, for I myself have been a close student of the progress of the mechanic arts the world over, and have been only too glad to recognize and avail myself of all that is good and worth adopting, assuming at the same time that improvement is possible and absolutely necessary in many cases to adapt the machinery designed abroad to the conditions that obtain in American workshops. The tendency to standardize everything is peculiar to this country. Builders of locomotives in America adopt standard sizes and types of locomotives, and are thus able to manufacture such to great advantage. Railroads in America are willing to take from the builders what has been shown to be good and effective, and when the same kind of machine is to be duplicated many times, the maker can afford to invest heavily in special gauges and special tools that decrease the amount of manual skill required in laying out the work or working to drawings. The first time a piece of work is done, whether it be small or large, simple or complex, more time is spent upon it than after the workmen have become familiar with its construction, and certainly more time than would be required after special appliances have been invented and made to cheapen the product, especially when the men are paid for their work according to the quality and quantity turned out, and not by a fixed wage per diem. I allude to this because I know it is the custom of foreign railroads to submit to builders in England and America specifications for engines that cannot compete in economy of construction with those that are built in quantities in the way that I have just mentioned. It is the recognition of this fact that is now opening the markets of Europe to American locomotives as they are built and as they are used in America. A celebrated builder of locomotives in England told me that the rules of Board of Trade and Parliamentary regulations for the safety of the people crowded their locomotives with useless appliances. A close observer of railroad machinery, who is familiar with the principal railroads in the world, has stated that if a locomotive builder abroad is given a new problem, such as to construct a hill-climbing freight engine, or a goods engine as it is called abroad, or even an express passenger engine for mountain districts, a complete machine may be the result that is a model of strength and durability, but inaccessible in the extreme when ordinary repairs are required. It is easier to take out the cylinders in an American engine and replace them with new ones than it is to reset the valves on the type in general use abroad, where the valve chests are crowded together under the smoke-stacks as though they would never require adjustment or resetting. The persistency evinced in adhering to the crank axle in English engines, in spite of its weakness, is one of the matters not understood in this country. Give accessibility to the valves, and ready access to all the parts, and the whole engine will be better cared for by those in charge of it.

It has been the scientific methods introduced by the managers of the railroads, aided by the skill and perfect equipment in their workshops, that have made those great railway systems what they now are. They must exercise the utmost caution in all that they undertake; every alteration or deviation from adopted standards involves so many pieces that must be changed. In regard to the simple matter of making brakeshoes for the cars, and boxes for axle journals I know from my own experience that it was not until the introduction of machines for molding these pieces accurately that the best results could be obtained and the parts made exact and perfectly interchangeable. Every invention, whether it be in the foundry or in the machine shop, is cumulative, and has its effect upon other trades, and through our ingenuity and progress we have now reached a point when the whole world looks to America for certain work which it seems cannot be done to equal advantage in other countries.

English Testimony on American Practice.

Dr. John Anderson, then in charge of the Woolwich Arsenal, England, was sent to this country to visit the Centennial Exhibition in 1876, and besides acting as one of the judges of the machine tool exhibit, he made an official report as British Commissioner to both houses of Parliament. Prominent in these reports there will be found one on "Machines and Tools for Working Metal, Wood and Stone at the Philadelphia Exhibition," in which the following statement occurs:

"Great Britain can certainly claim the credit of having been the birthplace of modern machine tools, and has done wonders in raising the mechanical standard of perfection, and her influence for good in the advance of civilization thereby is incalculable; but when we consider the enormously greater area of the American continent, it is a matter of vast importance that tools have taken such a hold of the American mind, which will influence the civilization of the Western world for ages to come, and will exercise a powerful effect, not only on that continent, but on Australia, China and the world generally." This, therefore, has a profound significance which can scarcely be overrated. Again he said: "The display of machine tools made by the United States was so vast that only the more salient points can be noticed in a brief report. It showed certainly that the past century has not been passed in idleness, and, judging by the enormous stride made by them during the past few years, it showed that they have been intelligent students of the best European authorities. It is true to say, however, that Americans, as a rule, are not copyists; the inventing of clever devices and tools for saving labor seems to be their natural forte, and worthy of the old stock, probably quickened by the peculiarly favorable circum-

*Extracts from an address at the 75th anniversary celebration of Franklin Institute, Philadelphia, Pa.

stances under which they live. It was the display made in this section which most conspicuously brought out the enormous strength of America as a producing power. More than a hundred exhibitors had each a large exhibit that commanded the admiration of all who took the trouble to examine them in detail. In this vast array were machines for all purposes, small arms, ammunition, sewing machines, clocks, watches, and all the branches of machine-making and engineering, and almost all were finished in a style superior to that of any former exhibition."

In the engineering practice of the first quarter of this century, scientific methods did not obtain. There was little technical literature to help the designer, and the best results which have made American ingenuity appreciated the world over were brought about through careful experiments and earnest effort on original lines. The history of the steam engine, so far as the American types are concerned, was clearly not the outcome of the books, for what is thus taught under the head of thermo-dynamics is really a description of what had been accomplished, rather than the cause of the development. The need of technical education was early felt, but the want was not supplied until the generosity of individuals rendered the foundation of technical schools possible. The government cannot be looked upon to aid in such institutions in the United States as it can in England, yet up to 1884 in London there was no technical school in existence that in any way compared with those at Hoboken and Boston in this country, besides which engineering is now taught in our universities. At a dinner given to the members of the Institution of Civil Engineers, in 1884, Sir Lyon Playfair, in responding to the toast of "The Universities of Scotland," after those of England had already been discussed by able speakers, astonished his audience by refusing to speak to the toast directly, and entered a stong plea for technical education in England such as existed at that time in the United States. He said they should not look to Germany and France for the examples of technical schools, but across the Atlantic, where those speaking their own language had already put into practice what England had so long needed. While the speaker was doubtless correct as to the wants at that time in Great Britain, the technical schools of South Kensington was then being organized, and the guilds of London had contributed freely toward its support. Good work had been done by this and other schools, and by the trade schools that have been established in various parts of England.

The Day of Empirical Methods Past.

We are long past the period of empirical work. The steel makers and iron founders now depend upon metallurgists to guide them, while every well-equipped machine shop in the country must have its staff of educated men who are able to reinforce the practical knowledge of those engaged in manufacturing by exact mathematical methods that in the early stages of our profession were limited to simple arithmetic.

As indicative of the necessity of education on the part of the working classes, I have known instances in which labor-saving machinery that was cheapening the output in a particular class of hardware in America, when introduced into England failed entirely and brought discredit to the member of the firm who had advised its purchase. A gentleman interested called upon me afterwards and solicited letters enabling him to visit some of the industrial establisnments in the United States. Upon his return from these places he told me that all that had been said about the character of the work done by the machinery in question, not only had been confirmed, but that its merits had been underestimated. He said, however, that in his opinion, it was impossible to utilize it to advantage with the workmen in England, owing to trade prejudice and trades union regulations. What the peculiar conditions were I am unable to say, but what I wish particularly to impress upon my hearers in this respect is that in his opinion the difference in the character of our workmen and workmen of the same trades in England is wholly due to the better education of the Americans, who are fully two generations ahead of those abroad. It is perfectly evident that it is impossible to raise the standard of work by means of labor-saving machinery unless the workingmen themselves will see the advantage derived from their ability to do more and better work, and thereby obtain better wages. This is particularly the case when they are called upon in this country to operate machines that do not require constant attention, but where it is possible for one man to attend several machines and earn higher wages than he possibly could if compelled to stand idly watching a machine that required but a small portion of his time to operate. There would be no inducement to contrive automatic machinery unless those who use such machinery are able without prejudice to take advantage of the saving in labor attainable thereby.

Ship-building all over the world, since the first iron vessels were launched, shows by the constantly improved output the wonderful progress in scientific knowledge, and in manual as well as technical skill. The great fighting machines for the ocean have been improved with astonishing rapidity. This year our own output in that line has for the first time been tested and found good, when handled by men of whom we as a nation may feel proud. The nations have been increasing their power of the fighting ships year by year, adding new improvements in machinery, new means of resisting attack from other ships, new guns and newer projectiles to pierce the new armor plate, and let us hope with decreasing opportunity to bring the results to actual test in battle. In our own recent experience, practice at great cost found our trained marine force better equipped for the operation of these fighting machines, and in the far East, and in the West Indies our guns swept a maritime power out of existence with upon our part scarce the loss of a man.

Introduction of the Forging Press.

In working iron and steel the introduction of the Whitworth forging press marked an important advance compared with the costly steam hammers, and hydraulic presses became absolutely essential in perfecting the American type of link and pin bridge construction. Some of the forgings required for the 5 000 h. p. dynamos needed by the Niagara Falls Power Co., could not have been executed by means of any existing steam hammer in this country or elsewhere, and the Bethlehem Steel Co. were the first to introduce this system of forging on a large scale. Forging by pressure in place of impact by hammers enables the force required to cause a given deformation of metal to be accomplished with the least expenditure of power and greater exactness, as was soon manifested in the readiness with which hollow shafts were produced. About 1893, the work at Niagara Falls called for steel rings of absoultely uniform density, having an outside diameter of 11 feet 4 inches, with a width on the face of approximately 50 inches, and a thickness of over 5 inches, which necessitated the use of a press of greater capacity than any heretofore erected. The press at Bethlehem, combined with the Whitworth system of compressed steel ingots, was taxed to its utmost to make what was needed in this case. It is interesting to note that this work was the first product of machinery introduced mainly to furnish armor plates and the massive steel forgings needed for our modern ships of war.

Niagara Power Plant as an Illustration.

The plant of the Niagara Falls Power Co. offers evidence enough of the remarkable progress that has been made, not only in the mechanic arts, but in the high scientific ability required to design machines that had no precedent in size or in exact requirements as expressed in the specifications predetermining each requirement as to the results to be accomplished. Thus the designers of the dynamos were called upon to guarantee an output from each unit of power with so high an efficiency that all the magnetic and electric losses in the machine would not amount to over 2½ per cent. This requirement was fulfilled, and when subsequent machines were installed, the result was even more favorable than in the first instance. The final result is the crucial test of all progress, and certainly we have in those of our industries which require mechanical skill sufficient evidence of the marvellous progress that has been achieved during the past 75 years.

As I have taken occasion to mention the work at Niagara Falls, which has engaged so much of my attention, it may interest those who are not familiar with the results of this undertaking to hear something further in regard to it. At Niagara Falls we had for the first time to construct a tunnel that would be adapted as a tail race to the development of

100,000 h. p. The International Niagara Commsision had decided that 5,000 h. p. was to be the unit, and the plant was accordingly laid out on this basis. It was assumed that water-wheels could be made of that capacity and could be placed 150 feet below the level of the dynamos to be operated, where, as one of the commissioners suggested, the length of shaft would be about the same as between the propeller and engines of an ocean steamship. In the practical solution of this problem we were obliged to have similar thrust bearings to guide the shaft, but the construction of the turbines is such that the water under the upper wheel of the two in the case is made to support the whole mass of about 160,000 pounds. The dynamo at the upper end of the shaft, therefore, practically spins on a cushion of water with only a pressure of 3,000 more or less on the thrust bearing rings, according to the variations in the velocity as the power developed is increased or decreased.

It is too large a subject to permit me to refer in detail to all of the work that had to be done at Niagara Falls, but I want to say that, while our constant effort has been to interest the manufacturers of machinery to make designs that they could guarantee, a great deal of designing has been necessary by the engineers of the company most of which was experimental, and that no failures should have been experienced is most satisfactory, when I realize how little precedent we had to guide us, and the risk attending the solution of the problem as it was presented to me.

The first three turbines that were installed in accordance with the design of the builders had to be materially altered and I have introduced improvements of my own invention to enhance their efficiency as far as the shaft transmission is concerned. These modifications were made in the five units that were subsequently installed, and without any change in the water-wheels, the efficiency was increased so that they delivered 5,500 electrical h. p. each, instead of 5,300 h. p., which was the output before the changes were made. As now constructed all the electrical and magnetic losses in each of the dynamos aggregate but 2½ per cent, and you can judge what the efficiency of the water-wheels must be when those which, at 75 per cent efficiency, would give 5,300 h. p., are now driving dynamos that deliver 5,500 h. p. without any changes in the wheel, but only such alterations in seemingly immaterial parts as the design of the connection between the water-wheels and the dynamos.

Additions to the Niagara Plant.

As regards the utilization of the power being developed at Niagara Falls it may interest you to note that we hope shortly to have ten dynamos running, each of 5,000 h. p. nominal capacity, but actually capable of delivering over 5,000 h. p. each. The first industry established in connection with the plant was a paper company, which required 7,200 h. p., but it installed its own wheels on land of the Niagara Falls Power Co., and utilized the latter's tunnel and canal facilities. Next followed the Pittsburg Reduction Co., which takes 8,550 electrical h. p. for the manufacture of aluminum. The Carborundum Co., for making abrasives, take 1,030 electrical h. p. The Union Carbide Co., 5,000 electrical h. p. for the manufacture of carbide of calcium. The Niagara Electro-Chemical Co., making peroxide of sodium, that is, metallic sodium, takes 400 electrical h. p. These and other works now in operation or being installed will utilize, possibly by the first of next year, a total of 41,000 h. p. Most of these establishments are electro-chemical or metallurgical in their processes, and have sprung into existence with the development of hydro-electric power, although they are based upon principles which were discovered years ago. The metal sodium, for example, is made commercially by practically the same process as was employed by Sir Humphrey Davy when he first began experimenting with the galvanic battery for the reduction of metals. The alternating current that has been adopted in the machines that generate this electricity is the alternating current as studied by Michael Faraday. The change in the potental from 2,200 volts at the machine to 11,000 volts in transmission is effected by the transformers that were dscovered by Faraday, and were formerly used chiefly in Ruhmkorff coils and other philosophical instruments. The principle as known then became useful for lighting purposes when the alternating current took its place in the lighting of cities.

In the problem presented at Niagara Falls we had to provide for direct current to operate railroads and for electro-metallurgical purposes. This power is developed as alternating current, and transformed from 2-phase into 3-phase by an invention of Mr. C. F. Scott, of the Westinghouse company. It is a noteworthy fact that, since the first wheels were started in 1895, there have been no stoppages of more than an hour or two at most. The plant has been in operation night and day, carrying on processes that permit of no interruption on account of the loss which would result.

Reviewing the century's progress, one cannot but be impressed with the tendency to specialize all industries. It has been truly said that jobbing shops are and always will be a necessity, but that manufacturing establishments will lead in the march of improvement. Trades are becoming more diversified, and time, talent and capital are being expended upon individual machines and appliances as special which were formerly but a part of the output of single establishments. To this concentration of the best thought upon special branches of all industries we may attribute much of the progress in the mechanic arts made during the past 75 years, which has opened the markets of the world to the products of our industry.

THE plant of the Niles (O.) Boiler Co. was more than tripled in size during the year 1899. It is now one of the most complete plants in the State, comprising boiler shop, machine shop, foundry and pattern shop, all equipped with latest and most improved machinery. From 150 to 175 men are given steady employment and the books are well filled with orders. The prospects for this year are bright, and it is expected a large addition to the machine shop will be erected.

BIDS were opened Jan. 29 by the board of control of the ctiy of Cleveland for five new pumping engines. The Holley Mfg. Co., of Lockport, N. Y., proved to be the lowest bidder for the four 25,000,000-gallon crank and fly-wheel engines wanted by the city. This company agreed to furnish two for $156,000 each and four for $154,000 each. The E. P. Allis Co. was the lowest bidder on the 20,000,000-pump, offering to supply it for $142 000. Mayor Farley made the statement that the bids were too high by $25,000 each, and they were rejected. A hearing of representatives of the company will be had on the price.

THE Cleveland Crane & Car Co., of Cleveland, now has under way in its shops, or in the course of erection, one electric crane for Reeves Bros., of Alliance, O., one for the W. S. Tyler Wire Co., of Cleveland, one for the Page Woven Wire Fence Co., of Monessen, Pa., eight for the Dimmick Pipe Co., of Birmingham, Ala., and one for the Fulton Foundry Co., of Cleveland. In addition several hand power cranes are under construction.

THE Maywood Foundry & Machine Co., whose incorporation with a capital stock of $50,000 was recently noted in these columns, is operating at present a foundry plant employing 40 men at Maywood, Ill., a suburb of Chicago, and a machine shop in the city, making the Wess molding machines and other machinery specialties, includng bolt cutters, and automatic key-seating machines. It is the intention of the company to build a consderable additon to its Maywood plant within a short time, removing the machine shop to that place. The election of officers of the company recently resulted in the selection of F. E. Lonas as president, I. L. McCord as secretary and O. H. Davison as superintendent. The city offices of the company are at 507 Monadnock Block, Chicago.

THE Rockwell Engineering Co., of New York, announces that it has succeeded to the business formerly conducted by W. S. Rockwell & Co., this being deemed advisable for the better execution of the rapidly growing business of the old firm, and as a proper means of associating in the new company a corps of skilled engineers who have done much to increase the business. The company has been very successful in designing and building furnaces for oil, gas or coal in connection with metallurgical operations.

HOW LONG WILL IT LAST?

Some Answers Given by the Foundry Trade.

With the view of ascertaining the opinions of the trade as to the continuance of the present prosperity of the iron industry, Rogers, Brown & Co. issued a circular letter on Dec. 26 to a large number of consumers of foundry pig iron, propounding three questions. There were received over 900 replies, and below are given the results. The firm comments as follows: "It will be observed that the outlook is most promising, and judging from these returns it is reasonable to suppose that the increased production of pig iron during 1900 will be needed to meet requirements."

Question 1.—"Based on our present contracts and prospective orders we believe the current volume of our business will continue —— months."

ANSWERS.

2	One month
10	Two months
25	Three months
30	Four months
16	Five months
232	Six months
11	Seven months
26	Eight months
23	Nine months
24	Ten months
345	Twelve months
2	Fifteen months
8	Eighteen months
4	Twenty-four months
1	Thirty months
1	Three to four months
11	Four to six months
1	Six to eight months
11	Eight to ten months
7	Six to twelve months
3	Nine to twelve months
1	Ten to twelve months
42	Twelve months, or longer
	Will continue to grow. Indefinitely increasing. Two or three years. Always.
35	About same as now
1	Less than one year
2	Will continue it prices of iron reduced
8	Will not continue
1	During season

883 reports.

Question 2.—"As compared with our consumption of pig iron in 1899, we expect to melt —— per cent more or less in 1900."

ANSWERS.

293	Same as 1899
2	Much more
4	Considerably more
10	5 per cent more
114	10 per cent more
7	12½ per cent more
31	15 per cent more
103	20 per cent more
123	25 per cent more
23	30 per cent more
16	33⅓ per cent more
2	35 per cent more
14	40 per cent more
63	50 per cent more
4	60 per cent more
12	75 per cent more
3	85 per cent more
1	90 per cent more
25	100 per cent more
2	150 per cent more
4	200 per cent more
2	300 per cent more
1	600 per cent more
11	Less
3	10 per cent less
1	15 per cent less
4	20 per cent less
10	25 per cent less
2	30 per cent less

890 reports.

Question 3.—"Our supply of pig iron on hand and contracted for will cover our requirements until ——."

ANSWERS.

9	January	73	August
46	February	59	September
78	March	34	October
102	April	17	November
86	May	10	December
80	June	49	January, 1901
255	July		

898 reports.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

At Whitesburg, Tenn., W. G. White & Co. contemplate erecting a wagon and carriage factory and are in the market for new and second hand iron and woodworking machinery; also one 12 h. p. traction engine.

The Bean-Chamberlin Mfg. Co., Hudson, Mich., are in the market for a back-geared drill press, small blower, medium exhaust fan and heavy geared turret lathe.

The Malleable Iron Range Co., of St. Louis, capital $40,000, has been incorporated by Silas McClure, A. C. Terrell and Mrs. B. S. Barnes.

The Birmingham Pipe & Casting Co. has been formally organized, officers elected and application made for a certificate of incorporation. The capital of the company is $55,000, and the officers elected are as follows: President, E. W. Abrams, of Chester, Ill.; secretary, F. E. Glenn of St. Charles, Ill. Directors, Joseph Winterbotham, J. F. Hatcher, H. K. Spencer, F. E. Glenn and E. W. Abrams. The purpose of the corporation is to manufacture soil pipe and castings. The Baxter Stove Works at Birmingham is being remodeled for the new company.

W. H. Graves will start at Delphi, Ind., a foundry to be operated by the Graves Machine & Foundry Co.

Fires and Accidents:—

At the South Williamsport Rolling Mill, Williamsport, Pa., fire caused a loss of $2,500.

Four boilers in the steel department of the rolling mills of Phillips, Nimick & Co., South Side, Pittsburg, exploded Jan. 29, wrecking the building, killing one man and seriously injuring several.

After 30 years' continuous running, the plant of the Minor Fire Brick Co., at Empire, O., was destroyed by fire Jan. 11. The company will rebuild immediately, doubling its capacity. These works have turned out in the last 30 years over 100,000,000 fire brick. An effort will be made to get out brick in from 60 to 90 days.

Fire in the machine shops of the Hall Plow Works, Maysville, Ky., did damage to the extent of $5,000.

New Construction:—

At Cincinnati plans have been prepared for a brick and stone factory, 80x210 feet, for the Watkins Laundry Machine Co. It will have iron trusses, traveling crane, milling machinery, boiler, engine, etc. Cost, $30,000.

The new Columbus Bridge Co., Columbus, O., is having plans prepared for an addition, 126x240 feet.

At Des Moines, Ia., the Crellin Structural Steel Co. will erect an addition to its foundry.

The Lorain Steel Co., Lorain, O., is having plans prepared for a machine shop, 300x106 feet. Two cranes, one of 25-ton capacity and the other of 10-tons, will be put in. The company are also making preparations to build 300 coke ovens.

An interest connected with the Expanded Metal Co., Pittsburg, will apply for a charter for the McDowell Mfg. Co., to erect a new plant at Millvale, Pa.

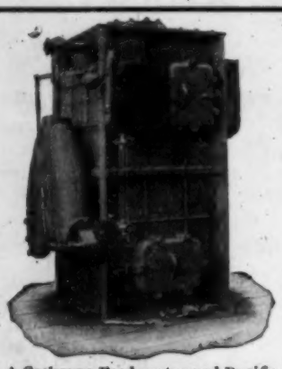
At Winona Minn., W. A. Salisbury will build a $5,000 machine shop 40x80 feet. Equipment includes air pumps, 60 h. p. gasoline engine, machinery for manufacturing marine and stationary gasoline engines, woodworking machinery, etc. Bids received after April 1.

A beginning will be made shortly in the erection of buildings for the Gruson Iron Works at Eddystone, near Chester, Pa. Bids are being received by David Townsend, consulting engineer, 1013 Betz Bldg., Philadiephia, for a two story brick office and drafting department 32x56 feet.

The Wilkes Rolling Co., at Sharon, Pa., has plans prepared for a new shed to be erected adjoining their muck bar mill. It will be 125x60 feet.

The Pittsburg District:—

The plant of the Pittsburg Steel Hoop Co., at Glassport, Pa., on the Monongahela river, will be put into operation



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IF YOU ONLY KNEW!

It is now an accepted fact, particularly well authenticated, that oil can be completely removed from exhaust steam. Therefore, why not bring the exhaust steam into actual, direct contact with the water that you want to heat for boiler feed purposes? Because then you save all of the heat—you get along with six pounds of water where it otherwise requires seven—you obtain REAL PURIFICATION by saving the pure condensed exhaust, and by obtaining precipitation and deposit; whereas, with a heater in which the steam and water are kept separate you cannot get any purification, except at the expense of the efficiency of the heating surfaces.

Why not get a heater that can be easily cleaned—one that will take less than thirty minutes?

The COCHRANE FEED-WATER HEATERS

WILL SAVE THE CONDENSED EXHAUST AND ITS HEAT FOR YOU—WILL GIVE YOU **Real Purification**—AND THERE ARE NO OTHER HEATERS MADE THAT ARE SO RELIABLE AND SO EASY TO CLEAN.

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about the middle of February. It has been under construction for some time and owing to the scarcity of material there was several months delay in getting it completed. At a recent meeting of the stockholders an increase in the capital stock from $150,000 to $300,000 was authorized. With the increased capital it is intended to install additional machinery. One of the new features in the rolling of bands will be the reduction of an ingot to the finished product with the necessity of only reheating half the material. An 8x8 ingot will be put through continuous rolls until rolled down to 4x4. This in turn is cut in two, the one piece being reheated for rolling into small bands while the other half continues without reheating and is rolled into bands from 2 to 10 inches wide. The equipment consists of one continuous furnace and two Siemens furnaces. There are five gas producers and three mills. The officers of the company are: Edward Bindley, president; W. C. Reitz, treasurer; C. E. Beeson, secretary, and J. J. Rebman, manager.

One of the two continuous bar mills of the Jones & Laughlins Co., Ltd., recently built, has been put into operation. When running full its output will be about 200 tons per day. The second mill will be ready for operation in about a month. This will increase the bar output of this company about 400 tons daily. The output of the steel plant will be increased from 300 to 400 tons per day by the installation of new soaking pits.

A permit was granted the Thomas Carlin's Sons Co., Allegheny, last week for the erection of a two-story ironclad building, to cost $25,000. Ground has already been broken for the building, which will be devoted to foundry purposes. In addition an electric plant will be installed.

Bair & Gazzam, Pittsburg, have just completed a set of machines for the Pittsburg Wall Papar Co., with works at New Brighton, Pa. The cost of the machines is about $125,000.

George Westinghouse, accompanied by H. H. Westinghouse, John Caldwell, and a number of personal friends made a tour of the Westinghouse plants at Swissvale, East Pittsburg, and Wilmerding last Thursday. They occupied the Westinghouse private car "Lucania" and after this tour of inspection they were taken down to the Edgar Thompson works at Braddock, and then to the Carnegie plants at Homestead and Duquesne. President C. M. Schwab, of the Carngeie Steel Co., Ltd., acted as host on this part of the trip.

Representatives of the Lukens Iron & Steel Co., whose large plate mill is at Coatesville, Pa., were in Pittsburg last week for the purpose of discussing plans for the extensive improvement of their plant with Mechanical Engineer Julian Kennedy. The S. R. Smythe Co. is completing six 50-ton open-hearth steel furnaces at Coatesville and the A. Garrison Foundry Co has received a contract for a three-high plate roll train. The Hydraulic Machine Co. will make the tables and housings for the rolls.

The Riter-Conley Mfg. Co. has placed a contract with the Chicago Pneumatic Tool Co. for 25 new style, long stroke, pneumatic riveters. Over 300 of the new riveters are in use in Pittsburg.

The Union Steel Co., Pittsburg, has contracted for the building of a 600-ton blast furnace and basic open-hearth plant. The Shiffler Bridge Co., Pittsburg, has been awarded contracts for erecting several buildings for the plant, but details are not given out as to their size and number. The E. P. Allis Co., of Milwaukee, and the Southwark Foundry & Machine Co. are reported to have the contracts for the engines. The report that plates will be manufactured by the new concern is not confirmed.

The new plant of the Harbison-Walker Co., brick and tile makers, commenced operation this week. About 200 men have been given employment and the number will probably be doubled later on.

The Carnegie Steel Co., Ltd., has just commenced the erection of the new blooming mill and 24 open-hearth steel furnaces at Duquesne, decided upon some time ago. These latest additions are on the site of the structure heretofore used as a carpenter shop.

The plant of the Mesta Machine Co., at West Homestead, Pa., will be put in operation this week.

The Carnegie Steel Co. last week closed purchases of property between Second ave., Pittsburg, and the river in Homestead, including about four acres. The plot will be used for extension to the Union Railway, West Homestead and the new axle works. The tract cost about $75,000. A rumor to the effect that the Pittsburg plants of the Carnegie Co. would be moved to Duquesne this year is denied by the officials of this company. It is not probable that the different plants will be removed for at least a year.

Chicago District and Northwest:—

While the year 1898 was a very satisfactory one to the Leschen-Macomber-Whyte Co., of 19-21 South Canal st., Chicago, manufacturers of wire rope and kindred specialties, the aggregate for 1899 showed an increase of over 125 per cent. The trade in wire rope from the coal and iron mines

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was very satisfactory and the indications are that 1900 will even go beyond the record of last year. The Stephen Humble patent safety hook for the prevention of accidents for overwinding at mines has been increasingly in demand. Among orders taken the past year, of which duplicates were received, are those of the Spring Valley Coal Co., of Spring Valley, Ill., and the Commonwealth Iron Co., of Norway, Mich. Both these mines have "overwinds" on their shafts and in both cases the safety hooks have worked well, preventing accidents that would have proved serious.

The Chicago Boiler Cleaner Co.'s turbine boiler cleaner has been successfully employed, the manufacturers state, in increasing the capacity and prolonging the life of water tube boilers, by removing the scale which had often accumulated to an extent that led to the discarding of this type of boiler. A firm in Kansas City, it is stated, reduced its fuel bill from $450 to $200 a month by employing this tool to clean its boiler tubes. Another in Minneapolis by cleaning its boilers obviated the necessity of purchasing additional power. The company is located at 828 Monadnock Block, Chicago.

The Franklin Foundry Co., 1155 South Paulina st., Chicago, has just completed making the castings for the large refrigerating plant the United States Government is erecting at Manila, P. I. The company is doing a very good business, and is running full to its present capacity.

The Standard Pneumatic Tool Co., Marquette Bldg., states that its mechanical superintendent, Henry James Kimman, after an absence of three months, has just returned from an extensive European tour. While in England he established works at Chippenham, near London, for the manufacture of "Little Giant" pneumatic tools for the European trade, and installed $50,000 worth of improved machinery and labor-saving appliances. The plant is in full operation and turning out tools in large numbers. Mr. Kimman says that the opposition to the use of pneumatic tools by labor organizations on the other side of the Atlantic is gradually dying out and many progressive concerns are installing machines. The company's export business has increased rapidly in the past year, pneumatic drills, hammers and boring machines having been adopted by some of the large foundries, ship yards, machine shops, railroad and boiler works in Great Britain, France, Germany, Italy, Sweden, and Russia. An order for $25,000 worth of pneumatic tools was received recently from a machinery dealer in Holland.

The boiler makers in most of the Milwaukee shops went out last week, asking for a nine-hour day, a $2.75 minimum, double time for old work and time and a half for new work, when working overtime. Some firms have signed the new agreement.

General Industrial Notes:—

The Keystone Bridge Works have just shipped over the Pennsylvania Railroad the largest girders ever handled in one piece. They are for the Riverside viaduct, New York, and weigh each about 62 tons. The two girders already shipped are of the box type and are 130 feet long, 10 feet 6 inches deep, and 3 feet wide. Four cars were necessary for the transportation of each girder. Two of the heaviest Pennsylvania Railroad gun cars were used and between them were placed two stone cars. The four cars were firmly blocked. Four other girders, each 130 feet long, 10 feet 6 inches high and 14 inches wide are now being constructed at the Keystone Works. This plant is making altogether about 6,500 tons of material for this viaduct and will require some months to complete the contract. The girders were designed under the supervision of Manager Emil Swenson, of the Keystone Works.

It is not at all probable that the steel plant projected for erection at Lockport, N. Y., will materialize. Mr. E. M. Butz and a number of Pittsburg capitalists offered to erect an iron and

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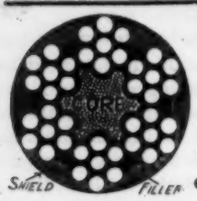

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steel plant at Lockport, providing a bonus was allowed, but the amount asked has not been subscribed and modifications in the contract demanded by the citizens of Lockport have been refused by the Pittsburg promotors.

The American Coke Co., controlled by the American Steel & Wire Co., has completed 250 ovens of the bee-hive type at the Dorothy plant, West Moreland Co., Pa., and will fire them up shortly. Rapid headway is being made on the other ovens that are being constructed for this company in the Connellsville district.

Nazel & Basset, of Philadelphia, have just received a large order for laundry machines, also one for hand portable drills.

The Gadsden, Ala., Furnace of the Alabama Consolidated Coal & Iron Co., at Gadsden, Ala., was blown in Jan. 18. On the same day the Talladega Furnace at Talladega was started.

The New York Air Compressor Co. reports sales of ten air compressors in as many days. These include a large duplex compressor for Japan and four compressors of 1,200 cubic feet capacity for the Pennsylvania Railroad.

The Cumberland Steel & Tin Plate Co., of Cumberland Md., has leased its new sheet mill, comprising four stands of rolls, to the N. & G. Taylor Co., of Philadelphia, who will manufacture black plates for tinning.

THE Cambria Steel Co. reports for the year ended Oct. 31, as follows: Gross earnings from operations, $2,486,037; Cambria Iron Co. rentals, $338,720; interest on 6 per cent bonds,

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$120,000; leaving net earnings, $2,027,337. After deducting dividend, $1,120,000, and state taxes, legal charges, etc., $98,958, the balance to profit and loss is $808,377. There was transferred from the Cambria Iron Co. at the beginning of the lease $394,751, making the total credit to profit and loss on Oct. 1, 1899, $1,203,129. At the annual meeting of the stockholders of the Cambria Iron Co., just held the following directors were elected: Josiah M. Bacon, Robert F. Kennedy, Charles H. Price, David Reeves, Powell Stackhouse, Edward S. Stotesberry, John W. Townsend, John Lowber Welsh and R. Francis Wood.

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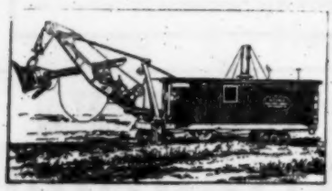

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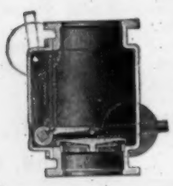

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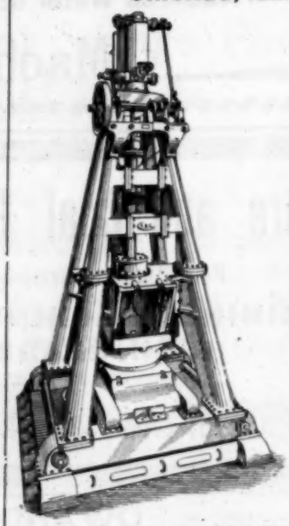

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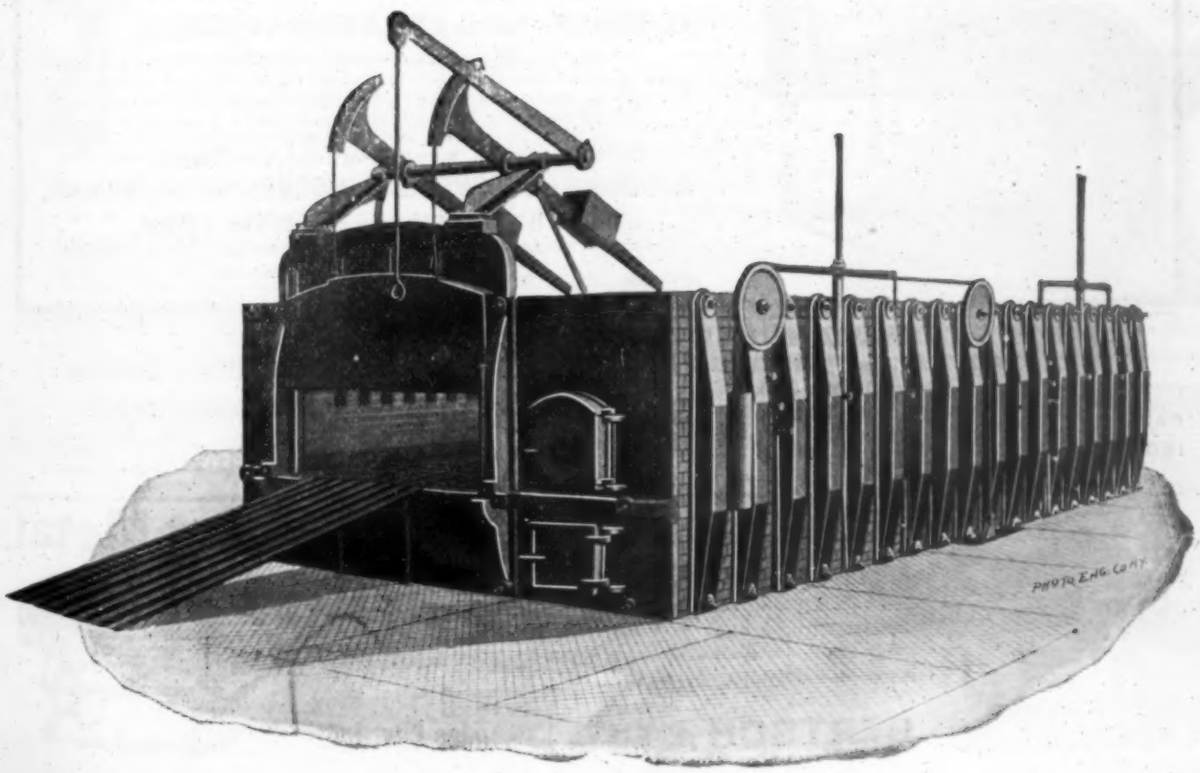

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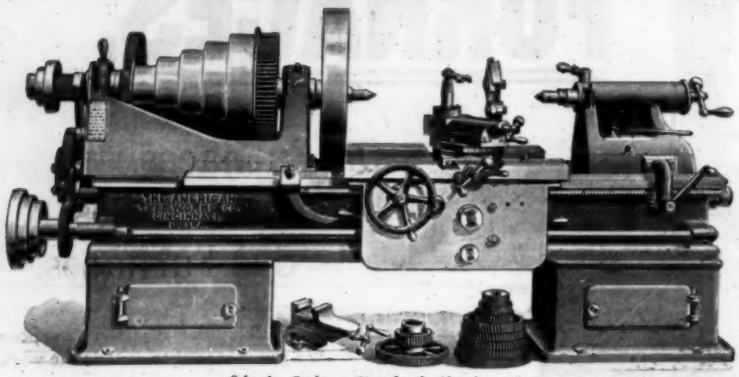

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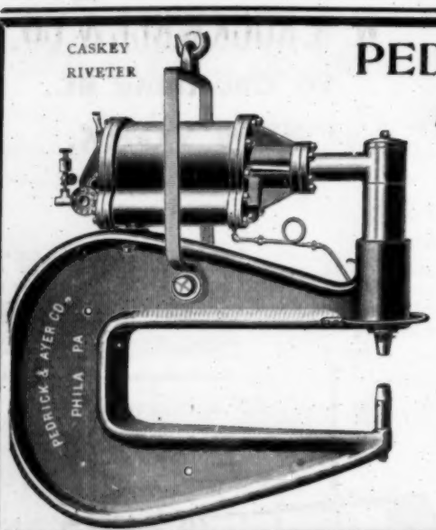

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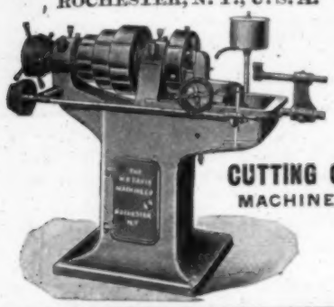

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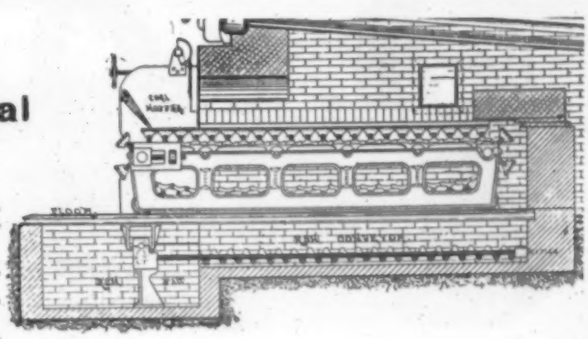

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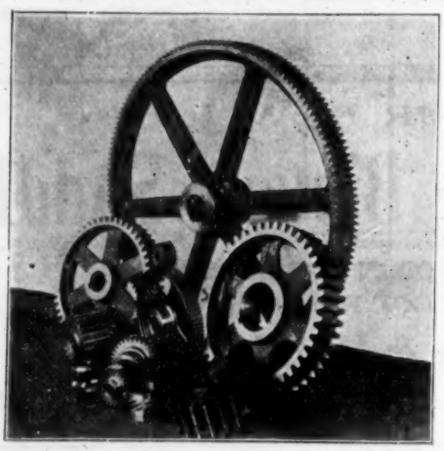

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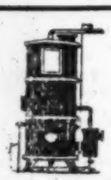

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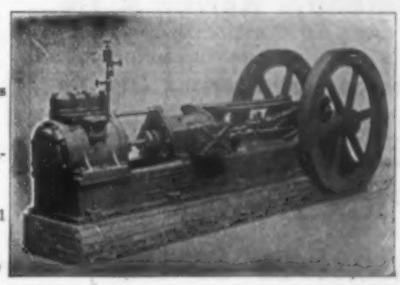

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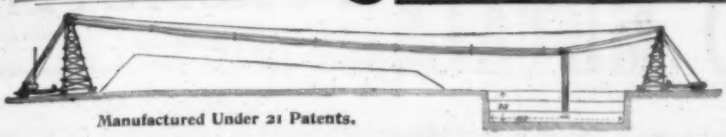

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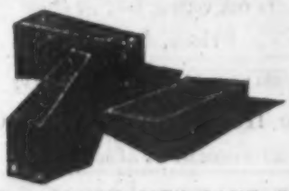

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18	13	11	Lorain Branch	12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:13	7:23	Lester	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport	.....	6:05	1:40
.....	8:25	.....	Bellaire	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

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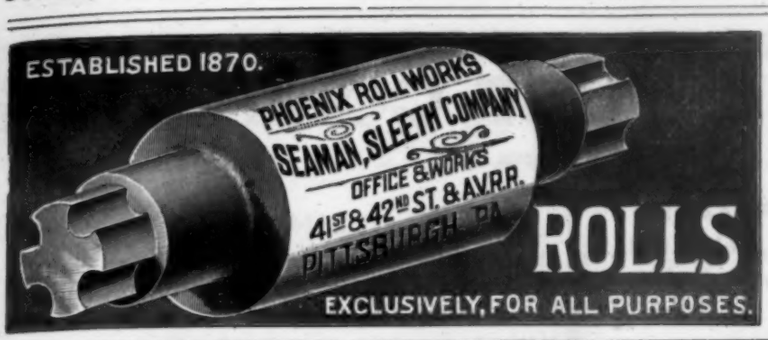

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In the preparation of the second edition of our Handbook, the general plan of the first edition has been followed, viz., to present in concise form such data and information as are useful to the chemist and metallurgist. Several tables of the first edition, which were of somewhat limited use, have been omitted, while more than one hundred pages of new matter have been added.

The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognised at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

Numerous miscellaneous tables have been added, which, it is hoped, will be found of value

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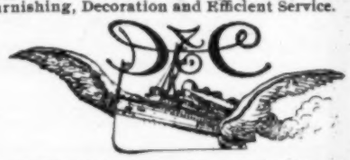

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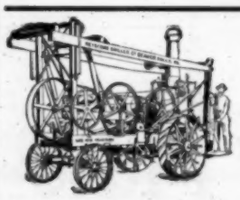

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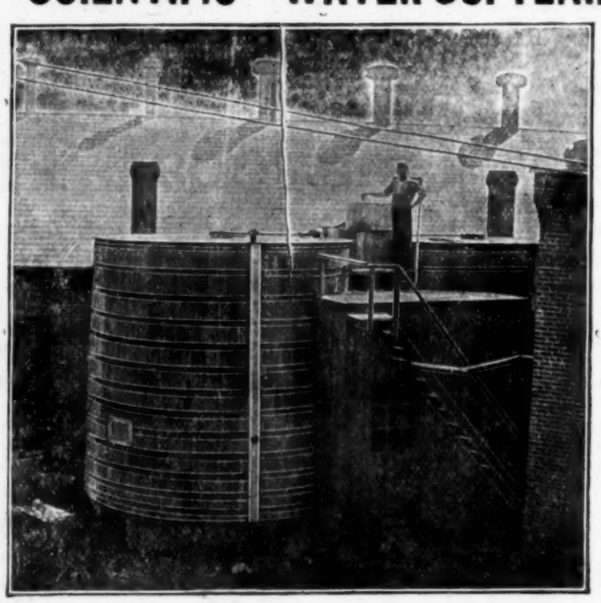

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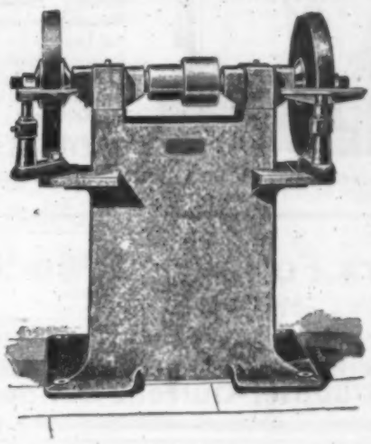

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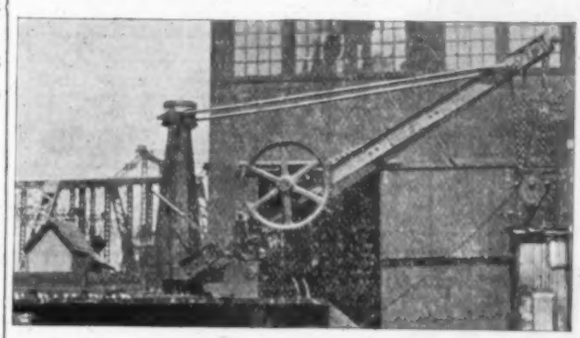

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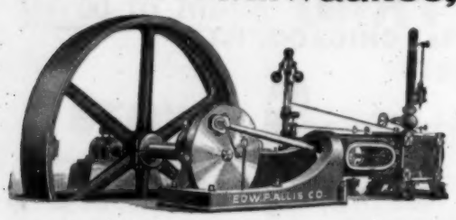

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Blowing Engines, Centrifugal Pumps,
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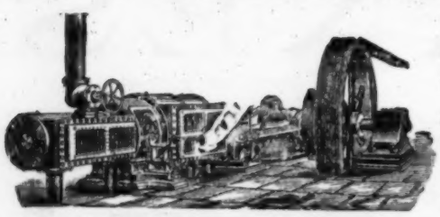
William Tod & Co.

YOUNGSTOWN, OHIO.

The PORTER-HAMILTON ENGINE.



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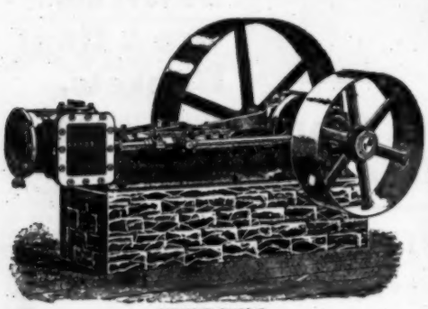
PARK BUILDING, PITTSBURG, - - Seward S. Babbitt.



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A well made and durable center crank engine of from 20 to 40 h. p. The design is thoroughly modern and all parts are made in duplicate. Engines kept in stock ready to run. Catalogues or prices willingly furnished. Among our other specialties are the

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Headquarters for Mill Gearing of all kinds and sizes Steam power plants complete

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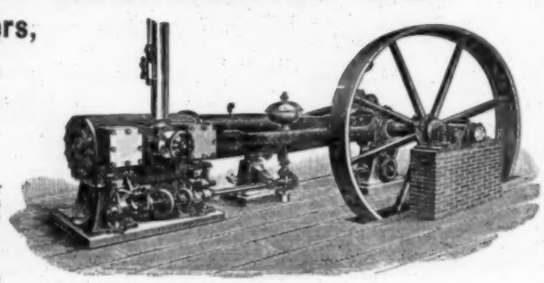

BUYERS' DIRECTORY.

AGRICULTURAL SHAPES—
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Fraser & Chalmers, Chicago, Ill.
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Ingersoll-Sergeant Drill Co., New York.
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Manning Maxwell & Moore, New York City.
W. J. Schaefer & Co., New York City.

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Manning, Maxwell & Moore, New York City.

AIR LIFT PUMPS—
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The Ingersoll-Sergeant Drill Co., New York.

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O. Textor, Cleveland, O
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John T. Jones & Co., Chicago, Ill.
Cremer & Bicknell, Cleveland, O.

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American Steel Hoop Co., Pittsburg, Pa.

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J. J. Ryan & Co., Chicago, Ill.

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Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
James B. Clow & Sons, Chicago, Ill.
Lorain Foundry Co., Lorain, O.
J. J. Ryan & Co., Chicago, Ill.

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Monongahela Iron & Steel Co., Pittsburg, Pa.
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Bourne-Fuller Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ills.
American Steel Hoop Co., Pittsburg, Pa.

BEARING METAL—
Magnolia Metal Co., New York City.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
F. R. Phillips Sons' Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

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Main Belting Co., Philadelphia, Pa.
The Jeffrey Mfg. Co., Columbus, O.

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Excelsior Iron Works Co., Cleveland, O.

BLAST FURNACE WORK—
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Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa
The United Boiler Co., Girard, O.

BLOWING ENGINES—
Southwark Foundry & Machine Co., Philadelphia, Pa.
Edward P. Allis Co., Milwaukee, Wis.

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The Wm. B. Pollock Co., Youngstown, O.
Cahall Sales Department, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
Hooven, Owens & Rentschler Co., Hamilton, O.
Harrison Safety Boiler Works Philadelphia.
Meehan Boiler & Construction Co., Lowellville, O
Wm. Cramp & Sons, Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
James Bonar & Co., Pittsburgh, Pa.
W. P. Davis Machine Co., Rochester, N. Y.
The United Boiler Co., Girard, O.

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BOILER COVERING—
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BOILER TUBE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa

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Upson Nut Co., Cleveland, O.

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U. Baird Machinery Co , Pittsburg, Pa.
Baush & Harris Machine Tool Co., Springfield, Mass.
Bickford Drill and Tool Co., Cincinnati, O.
Universal Construction Co., Chicago, Ill.
American Tool Works Co., Cincinnati, O.

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The Jeffrey Mfg. Co., Columbus, O.

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Lorain Foundry Co., Lorain, O.

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Shiffler Bridge Co., Pittsburg.

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Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

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The Pressed Steel Car Co., Pittsburg, Pa.

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Excelsior Iron Works Co., Cleveland, O.

CAR WHEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

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Hooven, Owens & Rentschler Co., Hamilton, O.
Macbeth & Co., Cleveland, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Stover Gasoline Engine Works, Freeport, Ill
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Lorain Foundry Co., Lorain, O.
Bethlehem Steel Co., South Bethlehem, Pa.

CASTINGS (ALUMINUM)
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRASS)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co Lorain, O.

CASTINGS (BRONZE)—
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Lorain Foundry Co., Lorain, O.

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Buhl Malleable Co., Detroit, Mich.

CASTINGS (Steel)—
Hercules Steel Casting Co., Harvey, Ill.

CEMENT—
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Reed F. Blair & Co., Pittsburg, Pa.

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Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
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Cremer & Bicknell, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
We Fu Go Co Cincinnati, O

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Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. B. Phillips Sons' Co., Philadelphia, Pa.
Lorain Foundry Co., Lorain, O.
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Robt. Aitchinson Per. Metal Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

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Rogers, Brown & Co. Cincinnati, O
Reed F. Blair & Co., Pittsburg, Pa.
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McKeefrey & Co., Leetonia, O.
Pickands, Mather & Co., Cleveland, O.

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Geo. B. Sennett Co., Youngstown, Ohio.

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Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co. Chicago Ill.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.

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Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

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American Steel Hoop Co., Pittsburg, Pa.

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Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co , Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

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Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co , Harvey, Ill.
The United Boiler Co., Girard, O.

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DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
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The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg Co., Columbus, O.

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DRILL PRESSES—
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W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
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Chicago Drop Forge & Foundry Co., Kensington, Ill
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Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
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Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg Co. New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co , Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
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Northampton Emery Wheel Co , Chicago, Ill.
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Walter Kennedy, Pittsburg Pa.
Heyl & Patterson Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. R. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

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James B. Clow & Sons, Chicago, Ill.

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Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

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American Tool Works Co., Cincinnati, O.

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Wm. Tod & Co., Youngstown, O.
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The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
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James Bonar & Co , Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
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Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit Mich.
Garden City Sand Co., Chicago, Ill.
A. P. Smith & Co., New Brighton, Pa.
Chas Taylor's Sons Co Cincinnati, O.

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FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
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Cleveland City Forge & Iron Co., Cleveland, O.
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Braeburn Steel Co., Braeburn, Pa
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co Cleveland, O.
Samuel Trethewey & Co Pittsburg Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Joseph Dyson & Sons, Cleveland, O.

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Brass Founders' Supply Co., Newark, N. J.
The Aultman Co Canton, O.
Schuylkill Iron & Steel Co , Philadelphia, Pa.
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Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co. Cleveland, O.
Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

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Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

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Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co , Cleveland, O.
The Ohio Sand Co Cincinnati, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire Brick Co Cleveland, O.
A. P. Smith & Co., New Brighton

Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

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Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

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FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

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Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

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The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GRAD CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

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Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

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Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
F. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
F. H. Bultman & Co., Cleveland, O.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANUFACTURING CHEMISTS—
Wefugo Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Cabeen Co., Philadelphia, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

ORE CARS—
The Pressed Steel Co., Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed P. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
F. H. Stroud & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co. Chicago Ill
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co. Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co. Milwaukee, Wis
Blakeslee Mfg. Co Du Quoin Ill
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia Pa
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
American Tool Works Co., Cincinnati, O.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. B. Phillips' Sons Co., Philadelphia, Pa
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Vulcan Foundry & Machine Co., New Castle, Pa.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt Aitchison Perforated Metal Co., Chicago
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

SECOND HAND MACHINERY—
L. K. Hirsch Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.
Geo. D. Moffat & Co., Chicago, Ill.

SENSITIVE DRILLS—
American Tool Works Co., Cincinnati, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago Ill
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPIKES—
L. K. Hirsch, Chicago, Ill.

SPECIAL MACHINERY—
American Tool Works Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co. Youngstown, O.
The United Boiler Co., Girard, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co. Chicago Ill

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co. Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa.

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co. Marion O
The Bucyrus Co., South Milwaukee, Wis.

STEAM SPECIALTIES—
C. H. Besly & Co. Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Cabeen Co., Philadelphia, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co. Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
National Steel Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa

STEEL CASTINGS—
Otis Steel Co., Cleveland O
Q & C Co. Chicago Ill
Bethlehem Steel Co., South Bethlehem Pa.
Hercules Steel Casting Co., Harvey, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STOKERS—
Playford Stoker Co., Cleveland, O

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
The Wm. B. Pollock Co Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
The United Boiler Co., Girard, O.

TANK CARS—
The Wm. B. Pollock Co., Youngstown, O

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

TIN AND TERNE PLATES—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. B. Phillips' Sons Co., Philadelphia, Pa.

TOOL STEEL—
C. H. Besly & Co., Chicago Ill
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

TRAMWAY EQUIPMENT—
Whiting Foundry Equipment Co., Harvey, Ill.

TRANSMISSION MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago.
Jeffrey Mfg. Co., Columbus, O
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

TROLLEY TRACKS—
Whiting Foundry Equipment Co., Harvey, Ill.
Northern Engineering Works, Detroit, Mich.

TRUCKS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TUBES—
National Tube Co., Pittsburg, Pa.
S. Fix' Sons, Cleveland, O.

TUBE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

TUBE WELDING—
S. Fix Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O

TWIST DRILLS—
C. H. Besly & Co., Chicago, Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.

WATER SOFTENING PLANTS—
Wefugo Co., Cincinnati, O.

WIRE—
American Steel & Wire Co., Chicago, Ill.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Company, Columbus, O.

WIRE MACHINERY—
S. W. Goodyear, Waterbury, Conn.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.

WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.

WROUGHT PIPE—
National Tube Co., Pittsburg, Pa.

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Illinois Steel Co	40
Ingersoll-Sergeant Drill Co	2
Iron Clad Paint Co	41
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Jones Foundry & Machine Co., W. A	1
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Wire Nail Works,
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Horse-Nail Works,
Locomotive Works,
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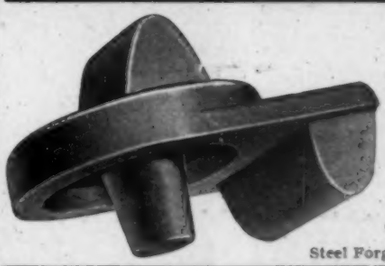

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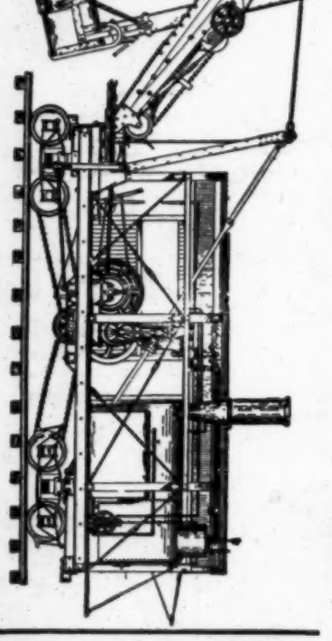

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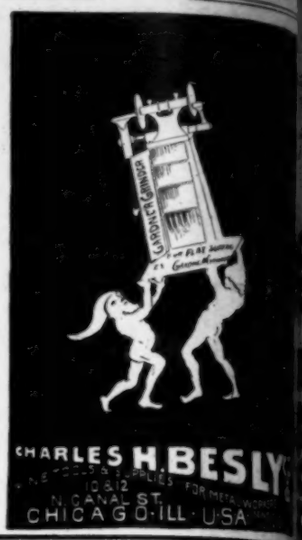

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